

In this Issue

WOMEN IN SLACKS
SPEED PLANE PRODUCTION

By Dan Wharton

JUNE
1942

AVIATION

The Oldest American Aeronautical Magazine

McGraw-Hill Publishing Company, Inc.

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In this world-wide war, giant troop carriers and cargo planes are a vital necessity to maintain supply lines to fighting fronts in both hemispheres. The Curtiss C-46, largest of the Army's great twin-engine transports, can carry tons of supplies and scores of men to combat zones thousands of miles away. The hundreds of C-46's now under construction will all be powered by dependable Pratt & Whitney Double Wasps.

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• • • • • IN THIS ISSUE • •

THIS IS A NAME AD

If you are—
a famous pilot between 21 and 41,
have over 140 solo hours logged
and meet minimum requirements for
Commercial Pilot's Certificate, and
aren't already engaged in one week
—let us help you.
See story on page 277



BOB HIRKSON traveled 10,000 miles nonstop without sleep from coast to coast to get the facts and figures for his story on how men in shells are spending plane passes. Hired from North Carolina especially, visited an altitude paces and finally wound up in the big city as the New York World Telegram. That is according to "American-Golden," Mrs. Fisher's "Standardized" book, due out for their next issue.

ONE OF THE MAIN REASONS underlying our participation in this war is that the Democrats are to lead the world in the cause of democracy. An outcome we have worked so hard to achieve is immediate offspring of winning the war, but the plain truth of the matter is that a great many people are dreading to think about what is to come after peace.

These are reigns of dangerous post-war realignments. People have visions of revolution at home, colonies in secession, bankrupt governments, inflation, bankruptcy and hard times.

A much greater truth, however, is this: If appropriate action is taken, there is no need for a post war stamp.

No country is invulnerable if its productive resources are intact and utilized with some degree of efficiency. After that war is over, we shall have the pre-

dictive capacity, technical equipment, financial resources and natural resources sufficient to produce a higher standard of living and a greater national income than ever before achieved in history.

As one of the nation's largest metal industries, outside of the war machine itself, the significance of the aviation industry, with respect to the planning and administration of post war reversion to peace or of the highest order—by the same token, the most important factor in any shortcomings in this regard are probably found in our airports.

It is rather too early, to plan, says the editor (page 71), least of all now, for other pilots will have to be leading the search out of shells and necessarily only to sink into the destructive atmosphere of our own neglect and shortsightedness?

The first published volume of a remarkable new guide to planning for post war shell world begins on page 80. Called the "Financial Drawing" process, by its inventor, Mr. Franklin D. Roosevelt, it not only efficiently forces out systems with difficult, compound curvatures, but also serves social and economic needs of the time and machinery required in other methods considered, used for the time being.

The story of the remarkable new method of working among the best and most advanced in the field of aircraft storage and aircraft cylinder head, as developed by Wright Aeronautical Corp., after five years of intensive research, is told on page 117.

In the Maintenance Section, begin-

ning on page 171, is a complete discus-

sion of service problems on aircraft en-

gine exhaust systems.

Coming

The July 1946 Aviation number of *Bell Aircraft* is one of the industry's old favorites, with nearly 40 years of active interest and participation in construction. First in flight, 1918; engine, propeller design and manufacture, however, is contained in its article (page 44) describing the massive landing gear that caused quite a stir up at Bell Aircraft. As early as 1926, Mr. George Westinghouse was engaged in the development of the first aircraft electrical system. Later he was with the Curtiss-Wright corporation for many years and in 1940 resigned to affiliate with Bell.



A production control study tells how one of the largest airplane manufacturers filled upon the largest business machine company to set up a central office which handles a Memphis, auto manufacturing plant. The studies developed make a fascinating work operation down to the smallest detail.

Another article will describe the methods employed to practice what a ranking officer of the Air Force describes as the world's "No. 1 Fighter."

There will be many other production features on aircraft, aircraft engines, aerospace and equipment plus divi-

Why ELECTRUNITE *Tubing*

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Even though Republic ELECTRUNITE Aircraft Tubing is produced by a fully-automated process that eliminates most of the uncertainties involved by the human element, every precaution is taken to assure absolute freedom from possible hidden defects.

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PIPER

POINTS THE WAY TO WINGS FOR ALL AMERICA

The Birdmen's Perch

ATTENTION PERCH PILOTS: We wish you could see the 100,000-head-on whooping crane migration over our paper. It shows a surprising bird-filled meadow from a sky high which is filled with birds. The perch is a picture of serenity and the whole is up to one of the handsomest things we've ever seen.

—Al Williams,
Editor, *Perch Wing Tip*, Gulf Aviation Products
Division, Phillips Petroleum Company, Pa.

This month we bring you tailored swing tips to welcome you to the group of professional Perch Pilots in the country.

We enjoy the opinions of those Air Training Commanders already favored, and the thoughts of many others which will be of assistance to you.

Our monthly column offers other pilot stories, news items, information to high school juniors and seniors who wish to ride planes. Many New York schools have joined the program and other schools around the country are requesting copies.

Working closely with the Bureau of Aeronautics and the National Weather Service, the ATECA will fit its much of the latest information and flight. That totals to an avg. 2,000,000 percent increase recorded by 1945—gives new for Uncle Ben and rough news for the Headline Chaser.

From the Gulf, Frank Fitzgerald, you know a 50 percent increase on this page. Will print your feature stories if they're fancy, your puzzle if they're puzzling. And if you can sure it, we'll send you the best news stories. Just write in—no names, no addresses, a "B" before a Perch Whopper Diploma." T.M.T.

THIS MONTH'S BRAIN TWISTER

A bid we know received part of a wing for work. He removed the old fabric from the wing and bought two new pieces,



use 2 long longer and 1 long narrower than the old ones, the other 3 long longer and 2 feet narrower than the old perch. All covered the same space.

What were the dimensions of the old perch?

(The dimensions of a perch are 36" x 36". Send us one and we'll give you the answer.)

A PERCH FOR OUR CAP

At present, lighter aircraft provide protection for fliers as only the shadowed sections

They were training flight tests on a plane which had been shot down—possibly captured or didn't want to glide.

CD, I think, heaves you hard at Gulf Aviation Gals.

Illustration G & G that you sent will show us what the life realmente like we use. I can see my friends at G & G. Before I start again, the G&G girls do it and reward us all with a good time. You boys at Gulf know what I'm talking about.

The gals wear very nice dresses—very light—very thin—very tight. I never see the G&G girls ever wear. Her clothes are very nice and G&G are the dressiest and well dressing girls I know.

I am surprised to hear of the G&G girls wearing the Hot and cold weather gear without tops and skirt. But who wants to look like a girl?

Given our boys are tall up there.

General Imperial Glass, Macker Men Chapter, Birmingham, Alabama, Ga.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

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AVIATION June 1942

18,400 spot welds in
7½ HOURS
on aluminum alloys

Tested installation of a Soule
resistor-welding machine with
G-E ignitron rectifiers at
the Gulf Oil Marine
Company to make an array of
18,400 spot welds in 7½ hours



**GET CONSISTENT, HIGH PRODUCTION
WITH G-E IGNITRON RECTIFIERS**
on inductive-type stored-energy welding

PROVED by more than 18 months of actual use in applying power to inductive type, stored-energy welding machines, G-E ignition rectifiers are helping users get fast, dependable operation—particularly in the aircraft industry.

Because of the low loss demand, the inductive type of stored-energy resistance welding permits the use of low-cost plant distribution systems and reduces voltage drop. It also permits stratification of welding machines at the most favorable point in the production line—even though this may be at some distance from the distribution transformer.

Good voltage regulation afforded by the low loss demand also reduces the possibility of light flicker and its interference with other welding equipment on the same circuit.

Designed by outstanding electronics engineers, these G-E rectifiers are built for ease of installation and low maintenance. Whatever your problems are, control for resistance welding—consult your nearest G-E office. Our control specialist will be glad to work with you, General Electric, Schenectady, N. Y.

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GENERAL ELECTRIC



**KLIXON
PROTECTORS
FOR
D.C. MOTORS
OF 30 VOLTS OR LESS**

You can now get low voltage motors—30 volts or less—with built-in Klixon Protectors. This means that more and more low voltage motors for aircraft, tanks, and other types of application will be protected from burnouts caused by overloading or over heating. Similar to the Klixon Protectors now used in A.C. motors of all sizes, these D.C. protectors are simple, snap-action thermostats, built right into the motor. They allow peak operation with safety. But if a motor gets too hot for its own good, its protector cuts it off.



Another Way to Save Copper

Klixon Protectors not only prevent over-heating and thereby saving heat losses, they save copper, too. These protectors make it possible to calculate at higher temperatures. Thus, you can produce a motor with a lower current rating. Klixon Protected Motors reduce it possibly by one-third the motors manufactured without them. That also counts in savings of copper.

Spencer Thermostat Co.

Attleboro, Massachusetts

AVIATION June 1942

1918

THE ACES OF WORLD WAR I

...still fly unseen today

TODAY'S planes, like today's phones, owe much to the pilots of World War I. For the lessons learned a generation ago, still are basic today. And those flying of World War I are giving just as generously today. They're giving their time, their experience, their help—help which profoundly influences every phase of flying. Training, combat tactics, strategy, aircraft design—all are the continuation of experience to youth.

Recently, a notable example was the tour of Col. Eddie Rickenbacker and Col. Frank Murphy. They covered combat units of the Air Forces in the United States to help train young pilots in the psychology of aerial combat. Then, they're passing on to student pilots the priceless heritage of experience which made them outstanding aces of World War I.

At McDonnell, in the production of precision dash aircraft and parts for our armed forces, we recognize an obligation—to see that what we build is worthy not only of the flyers of World War II, but worthy also of the heroic traditions of the Air Corps...traditions made by the flyers of World War I.

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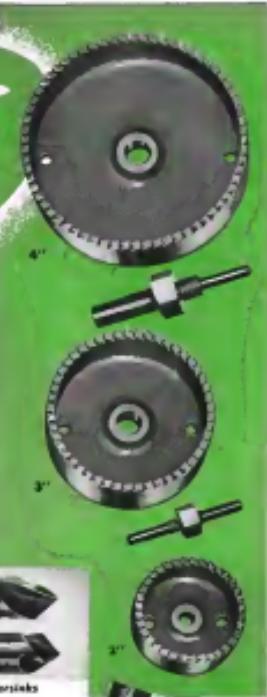
Hightowing enemy bombers will get a warm welcome—400 warm, no doubt—from Uncle Sam's TP-48s! These hard-hitting, high altitude fighters, known as "Lancers", can go up and blast any enemy bomber out of the sky. They are one of the Army's most powerful and maneuverable single engine pursuit planes—and do their best work above 20,000 feet. Here again, you'll find friction free Fafnir on the controls—providing the extra smoothness, tailoring responsiveness and safety that help to make the "Lancer" a truly great fighter!

Fairer Aircraft Ball Bearings were developed in ten years of close cooperation with the aircraft industry. Fafnir has reached, step for step, the strides of the aircraft industry in its greatest period of advancement. Today, the outstanding performance of Fairer Aircraft Ball Bearings is not only attributed to Fafnir's own manufacturing and engineering excellence—but to the genius of many leading aircraft designers, engineers and builders. The Fafnir Bearing Company, Aircraft Division, New Britain, Connecticut.

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All Aerocraft cutters are accurately ground for correct cutting angles and clearances—flutes are highly polished to dissipate chips.



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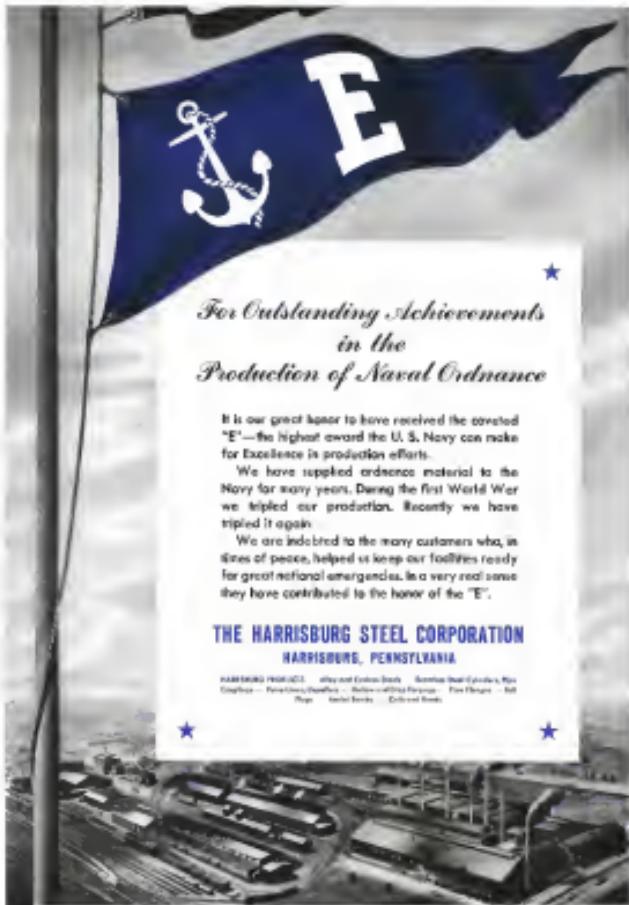
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We are indebted to the many customers who, in times of peace, helped us keep our facilities ready for great national emergencies. In a very real sense they have contributed to the honor of the "E".

THE HARRISBURG STEEL CORPORATION
HARRISBURG, PENNSYLVANIA.



If it isn't, you're missing a *sure* thing. Resistance welding with the "canned lightning" of stored energy machines is accomplishing a real production miracle in many aircraft plants...by making possible better designs...by achieving faster assembly with fewer heat treatments and thus lighter structures, and savings in assembly costs up to 50%.

The operator of the spot welding machine above is joining a reinforcing element to the central standard for an airplane wheel column used on a modern warplane. His work is faster than a two-man riveting crew . . . and doesn't need to drill holes or use die gages or back rivets. The finished assembly, spot welded, is stronger, lighter and just as strong and corrosion-resistant as a comparable riveted member.

In helping to develop the super-agency assembly method for plane manufacturers, Miller has consulted in those important areas:

II. By supplying Malleotron Capacitors to the makers of impulse welding machines. These Malleotrons assist build up the charge of "stored lightning" needed for high-current, high-load, high-speed spot welding of aluminum and its alloys.

2. By producing a classified spot welding tips type of the current contour and material... in this case malleable iron alloy A or Mallory³, dielectrically normalized and proven ideal for aluminum welding. Thus Mallory Tips are at highest possible production speeds, greatest number of welds before replacement is necessary... better and faster welding at lower cost. And since these tips by Mallory are classified, they are available promptly when you need them.

3. By developing Molloy Tip Holders designed to withstand exceptionally high loads, permitting optimum electrode pressures.

Mallory's products serve so vitally and at so many points throughout the aircraft industry . . . from communications systems to "green" engine test stands . . . that you'll probably want to talk over one or more of your problems with Mallory engineers. One time is your time. Drop us a line if you want engineering help and a file of technical bulletins.

*See U.S. Pat. 3,1

P-3: 20140827 A 09: 100 - 100% 相對性與相對運動的物理學 - Page 10 of 10

MALLORY

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POTTSVILLE, PENNSYLVANIA, U.S.A.

End of Rehearsal...

While the Axis rehearsed in China and Europe for the war, America's seventh industry—aviation—expanded and completed United States aircraft production within the United States and where in the front line of our defense. It is a dead serious dress rehearsal for today we designed greater strength matched suspension and gear for greater power production. That's why American planes are the world's hard-hitting planes. That's why we are building more of them today and will build not more tomorrow. That's why the country inevitably will be won to the United Nations. For that country Lockheed—first American mass producer for the Royal Air Force—Jacobs P-38 Lightning interceptors, paravane and箔面反潜侦察机, Lockheed Aircraft Corporation, Burbank, California.

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★ Extremely light in weight, suspension (Downshift) emphasizes a high strength-weight ratio with toughness and fatigue endurance.

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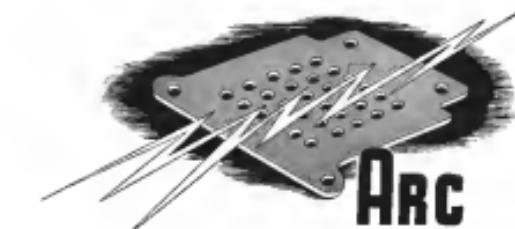
which is to which should
with parametric live in
the B-52 aircraft with a
protecting member which
is designed to withstand
any impact or damage resulting
in the aircraft. A suitable means of
incorporating G-dome leaf
padding and absorbing energy
is to use a thin sheet of
G-dome leaf padding.
This sheet is to be
fastened to the inner surface
of the aircraft fuselage.
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be about 200 feet
long by 10 feet wide.
It is to be filled with
the following G-dome padding:
A circular area, not the
circular when the plane
made a direct impact plan
because the aircraft
changes that is designed
so that the sheet is trans-



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AVIATION, June, 1942

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... says
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AVIATION SCHOOL
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SNAP-ON TOOLS CORPORATION, 8020F 28th Ave., Kenosha, Wisconsin

AVIATION, June, 1942

OVER 3000
HAND AND POWER
TOOLS—FROM
MINIET WRENCHES
TO HEAVY DUTY
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SPARTAN

Makes Every Minute Count...

in AMERICA'S FAVOR



TIME is vital . . . TIME is Victory . . . and the never-ceasing hum of precision machinery in the Spartan Aircraft factory helps to swell the roar of America's tremendous war production program . . . as important government contracts are fulfilled in the speedy, unerring manner that time and the emergency demand.

With experience in building the famous Spartan "EXECUTIVE", one of America's most dependable and efficient all-metal cabin planes—and with plant capacity recently doubled and soon to be doubled again—Spartan is making every minute count in America's favor. Out of the valuable lessons and experience of today Spartan is seeking the development of even greater Spartan aircraft to serve a flying America after this war is won.

SPARTAN SCHOOL OF AERONAUTICS

A division of the Spartan Aircraft Company, serving as a dependable source of supply of expertly trained aeronautic workers—for the Spartan factory and innumerable others in the industry. With 21,369,000 hours of instruction and superior training courses, Spartan School rates as one of the most outstanding in the U. S.



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SINCLAIR REFINING COMPANY (Inc.)

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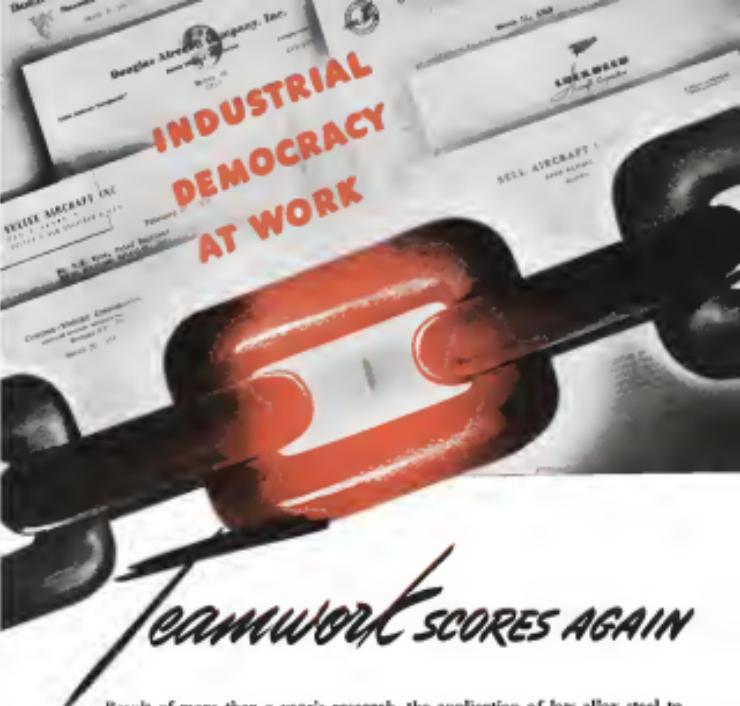
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For Supplies
In Weeks

AVIATION June, 1942



Teamwork Scores Again

Result of more than a year's research, the application of low alloy steel to aircraft structures was immediately made available by North American Aviation to other aircraft manufacturers. Here is another demonstration of teamwork in the aircraft industry. Individual manufacturers are on the alert for ways to win the war. They are working together the American way.

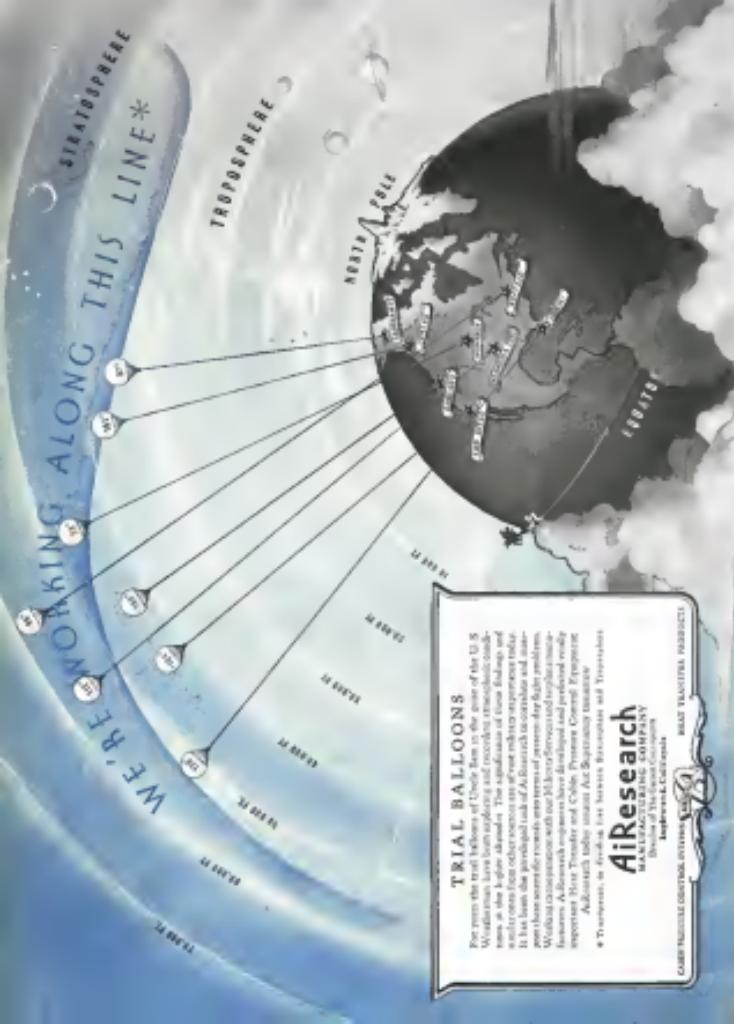
NORTH AMERICAN AVIATION, INC.

INGLEWOOD, CALIFORNIA

Member of Aircraft War Production Council, Inc.



BUILD AND FIGHT WITH TEAMWORK THE NORTH AMERICAN WAY



TRIAL BALLOONS

For more than half a century the U.S. Weather Bureau has conducted a series of experiments to determine the behavior of the upper air. The significance of these findings and information from observations at the upper air stations is of great interest to many. It has been the privilege of AiResearch to contribute and observe these remarkable research efforts of government, Army, Navy, universities, Weather Bureau, engineers, and meteorologists and to help develop and produce reliable instruments for these important investigations. AiResearch engineers have developed and produced reliable instruments for the U.S. Weather Bureau, the National Weather Service, the Air Force, the Navy, and the Army. AiResearch is located in Santa Barbara, California, and Tempe, Arizona.

AiResearch

AI RESEARCH COMPANY

Division of The Boeing Company

Seattle, Washington

CAMP NARCISSUS GROWTH CENTER
NARCISSUS, CALIFORNIA

"Well done, Wildcat"



... home to an carrier base—back from a rough job well done. Grumman F4F-3 U. S. Navy "Wildcat" enjoy an illustrious record of performances—a reputation that the increasingly numerous task of combat flying makes all the more enviable.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
ALLENDALE • ALLENDALE, NEW JERSEY



Spring 1942 Test Flight
AVIATION June 1942



Power to win!

VICTORY after victory in the air is proving the fighting power of planes using Allison liquid-cooled engines.

Allison is the engine which powers the Curtiss Tomahawk P-40's cited here—the engine which makes possible the same sharp-nosed streamlining of other U. S.-built fighters.

And now as the news of their triumph pours in from all fighting fronts, it justifies the confidence of those aircraft designers and U. S. Army Air Corps engineers who built these great ships around Allison liquid-cooled engines.

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MEN AND MACHINES

The men of Muskegon possess technical training of the highest order, backed by a vast experience in piston ring manufacture — over 1,000 million rings. Their machines embrace the latest technique of science

and machine design. Small wonder that this forward-looking group, thus equipped, is consistently improving the product through research (*) — constantly guarding its quality through rigid production control.

The frequent contact and close cooperation of Muskegon's men with their customers often result in real contribution by Muskegon to the solutions of piston ring design problems. This cooperation is available to all who use piston rings.



MUSKEGON
Piston Rings

MUSKEGON PISTON RING CO.
Muskegon, Michigan
PLANTS AT MUSKEGON AND SPARTA

Clearing the Sky for Peace!



Today Bell workers go about their jobs with whole-hearted determination. Building the world's deadliest single engine fighter is a grim affair, but Bell Aircraft has promised a supreme effort in clearing the sky for peace. To that end, every man

and machine and tool at Bell Aircraft is dedicated. There will be no other thought until America ends its fight for a world in which men are free to enjoy "life, liberty and the pursuit of happiness."



**BELL Aircraft
CORPORATION**

BUFFALO, NEW YORK, U. S. A.

Making Aviation History

AVIATION, June, 1944

Designed and being used for WAR

STREAMLINED with a 30% saving in weight—SIMPLIFIED by the elimination of 7 parts and designed so that it can be completely disassembled and serviced with only a screw driver and pliers—**INCREASED IN PERFORMANCE**, through more extensive use of Bendix Plastic elements and resulting in 50% lower handle load—this is the outstanding merit of the new war-standardized Bendix Hand Pump.

The extreme simplicity of the new design makes this pump a fast production item. It has been designed to meet the new AN Standard, and has demonstrated an extended efficiency in a life test of 110,000 cycles. In addition to Plastic poppet valves, the new pump incorporates a Plastic piston head and case bearing—further increasing the remarkable service life of this equipment as well as reducing additional weight for other uses.

The new Bendix Hand Pump—Model 2232-B25—is now specified for use on U. S. Army airplanes.

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BENDIX AVIATION, LTD.
STANDARD HAND PUMP

DISCONNECT COUPLINGS POWER BRAKE VALVES CHECK VALVES PRESSURE REGULATORS
HAND PUMPS ACTUATING CYLINDERS HYDRAULIC ELECTRIC SWITCHES RESTRICTOR VALVES
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"Take a note, Miss Walsh,
to men with production troubles"

HECKER may have the answer to your tool, jig and fixture problems. Many of the country's leading airplane and war production plants are using **HECKER** tooling service. And they come back for more, regularly.

The **HECKER** plant is a proving ground for a lot of new tools. You see, in addition to being designers and builders of tools, jigs and fixtures, we're fabricators of airplane parts for other manufacturers. **HECKER** tools do an efficient job in our production. They'll do the same for you.

HECKER tool engineers follow these

designs through to completion, even placing them in production, when desirable. Because these engineers know what to expect of men and machine tools, yet get maximum production when **HECKER** tools, jigs and fixtures are on the job. If we can help you, write A. W. Henken, 1078 East 65th Street, Cleveland, Ohio.

A-W+

HECKER

DESIGNERS AND BUILDERS OF TOOLS, JIGS
AND FIXTURES — FABRICATORS OF AIRCRAFT PARTS

AVIATION June 1946

"THE AVIATION INDUSTRY HAS WAITED
25 YEARS FOR THIS DRILL!"

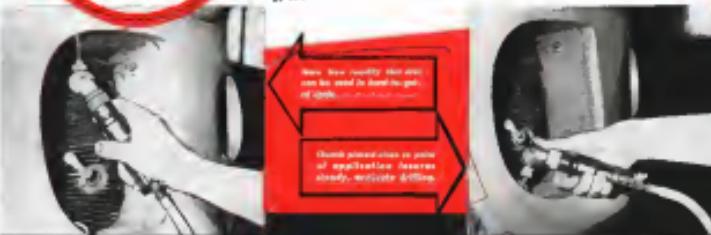
CLECO
MODEL 9D020 DRILL

has these exclusive features:

- 1 The 9D020 drills at any angle and in any plane—at all 360 degrees of the circle.
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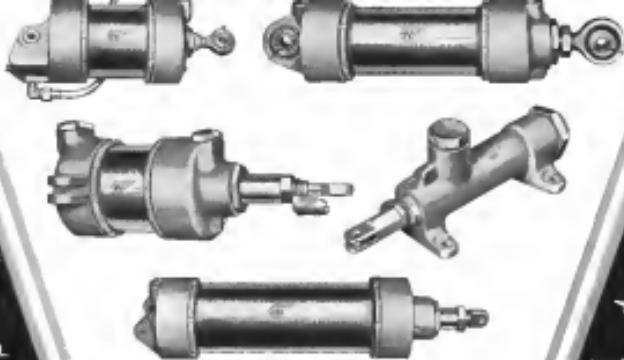
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WEATHERHEAD HYDRAULIC CYLINDERS

WEATHERHEAD hydraulic retracting cylinders are being supplied in volume to major aircraft companies.

Like all other Weatherhead airplane parts, these cylinders are manufactured to Air Corps, Navy, and "AH" specifications or standard production.

Each engine part that Weatherhead produces has been engineered not only for performance, but also for mass production to provide the increasing output an essential factor. In addition to hydraulic cylinders, these parts include Dural Take-off Pipe Fittings, Vacuum Selector and Check Valves, Hydraulic Check Valves, and High, Medium, and Low Pressure Hydraulic Flexible Hose Assemblies.

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AIRLINE DIVISION
Main Office: Cleveland, Ohio
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Standard Metal Co., Inc., Detroit, Michigan



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Powered by Lycoming

Eyes for the Army and swift courier service for the military command... those are the duties of the rugged, low-flying Stinson L-49's. The unfaltering dependability and highly economical operation of Lycoming aircraft engines provide important requisites for the successful completion of such missions.

Four Lycomings power four to six 177-h.p. horizontally opposed or one or two 180-h.p. radial engines. Write Dept. AIA, Lycoming Aircraft Division.



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LYCOMING DIVISION, THE AVIATION CORPORATION



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For
Performance
"Under
Fire"



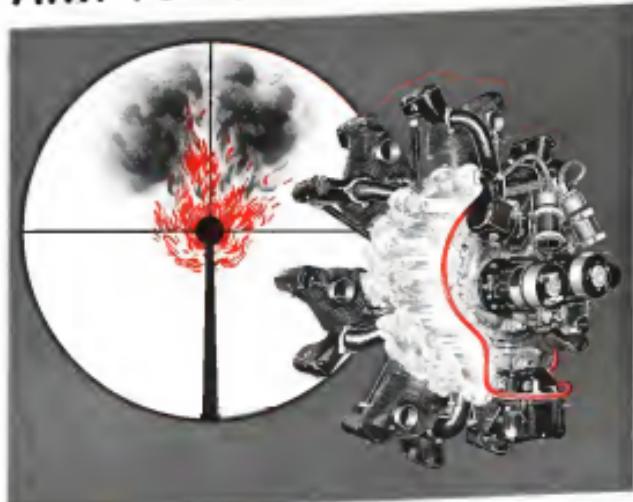
Built by ECLIPSE AVIATION — Division of Rovelli Aviation Corp.

It is significant that Eclipse Aircraft Accessory Equipment — "accepted as standard by the Aircraft Industry, Airlines and Military services for more than 20 years" — is **LUX™**-equipped. For the outstanding performance of its delicate mechanisms on the highly maneuverable planes of today is proof that **LUX™** Bearings pass the most critical tests "under fire." Equipment upon which human life often depends invariably relies upon **LUX™**'s.

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SKF
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AIM TO **KILL FIRE...**



BLAST IT WITH SNOW-AND-GAS!

Don't give engine fires a chance—in the air or on the ground. Aim at the heart of these, blast them out quick! Aim your plane with a bullet **LUX** fire-extinguishing system. It's the system that passes the dead by fire-killing power of **LUX** carbon dioxide snow-and-gas. It operates with the simple pull of a handle.

Another's fastest fire-killer, **LUX** gas kills engine fires in 3 or 4 seconds. Yet it blows off the cold, clear and dry gas

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If you want completely automatic fire protection, use **LUX** flame detectors or the detecting elements of your bullet **LUX** system. There are **LUX** fire-extinguishing systems for both radial and "in-line" engines, single and multi-motored planes.

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SUNNEN
Precision
HONING
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Average Number of Pieces from
Header Die Increased from
25,000 to 225,000!

That's **MORE** Production



Write for
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For complete information and
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se great machines, send today for
the free catalog and accessories via
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...inches — an increase of nearly 1000% in the number
of pieces from a die after it had been Sunnen honed!
That's the kind of increased production Donald Nelson
is calling for—the kind that will help us speed the day of victory.

Of course, we can't assure every manufacturer such amazing
results—but increases in production of 100% to 300% can bring
spectacular results daily.

If you are resurfacing or grinding internal cylindrical surfaces
from 185° to 2,000° in diameter, it will pay you to get full
information on this precision, inexpensive, reliable equipment at
once. Consider the values of these outstanding features:

1. Does not require skilled labor.
2. Requires less inferior grinders
for other jobs.
3. Can be set up and work located
in one minute.
4. Accuracy within "one-tenth"
guaranteed.
5. Produces super-smooth
finishes.
6. Die adjustment can be
made with machine in motion.
7. Corrects errors of out-of-roundness
or taper caused
by previous operations.

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SUNNEN



Airplane Aircraft Tire/Tire
Spoke Wheel Hub Wheel
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Airplane Aircraft
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Airplane Aircraft Tire/Tire
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Airplane Aircraft Tire/Tire
Spoke Wheel Hub Wheel
Assembly

Recent tire assemblies in
various aircraft from the
United States and Europe

"Spoke" or extremely precise
and smooth finish

Spoke tire assemblies from the
United States and Europe

Spoke tire assemblies from the
United States and Europe

etc.

Information on installing PLEXIGLAS aircraft sections



Plexiglas has been used in military aircraft since 1935. In non-operational areas—gas tanks, cockpit instrument enclosures, radio, radio masts, fuel tanks, landing light covers, and antenna housings—Plexiglas components similar to those seen in this picture of the Bell Mustang are to be found on every kind of fighting plane built in America.



For mounting Plexiglas sections on aircraft, the new **PLEXIGLAS**—Methods of Installation, flexible sections, full-size sketches similar to those shown above. Write for your copy today.

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ACRYLIC PLASTICS**

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SHEETS AND RODS

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MOLDING POWDER

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Manufacturers of Optical and Technical Specialty and Filter Glass, Synthetic Resins, Acrylic Plastic, Acrylic Insulators, Acrylics, and the Metal Oxides





THAT'S what this war is . . . a finish fight . . . and we who make the finishing materials for three out of four American fighting planes, are proud to do our part in seeing that it's finished right! The sooner the job is finished, the sooner the world's big, peace-time air age can begin.

BERRY BROTHERS
BETTER, MORE BETTER



ROSTER • 1939 GTI • SPARKPLUGS
EXHAUST • CLUTCHES • BRAKE LINERS

BERRYLOID
AIRCRAFT FINISHES

AVIATION, June, 1942

Speaking of Responsibility...

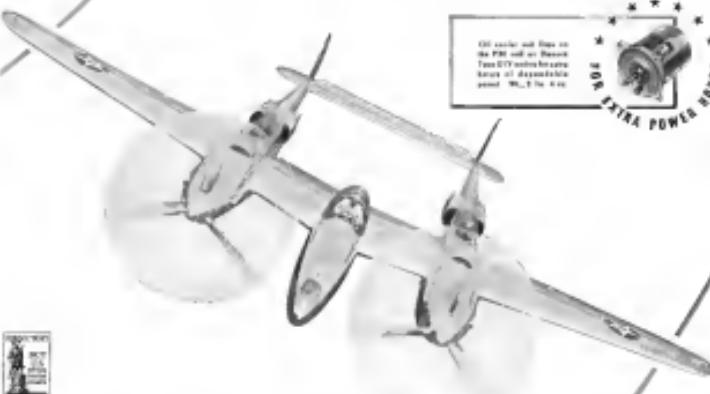
Unfailing combat performance

America's fighting aircraft must ful-

fill this responsibility for the protection of all that we cherish as Americans. In pursuit ships, Dumore fractional horsepower motors are engineered to give extra hours of dependable power far beyond normal service requirements . . . they have what it takes when the going is tough and loads are heavy. That's why specially designed Dumore aviation motors are selected to operate anti-icer pumps, cowl and wing flaps, oil cooler exit flaps, rudder tabs, trim tabs, windshield defrosters, ammunition booster units and many other vital controls on fighters and commercial craft. Why not consult Dumore engineers about special applications of precision power to your control problems?

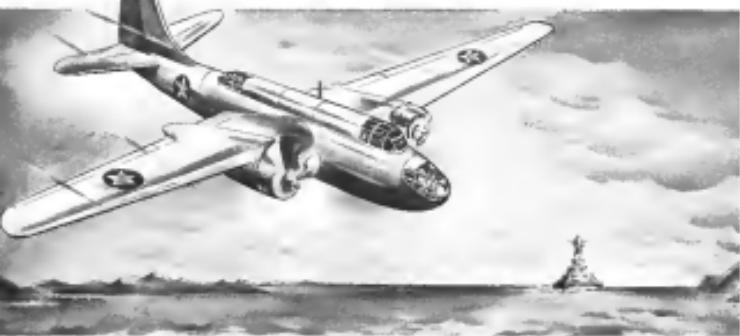
THE DUMORE COMPANY, 382-F, RACINE, WISCONSIN

MANUFACTURERS OF TRADITIONAL HIGH-PERFORMANCE CONTROL MOTORS



EXTRA POWER 20%

VITAL ★ DEPENDABLE ★



That's American Aircraft's Contribution to Victory

★ The contribution to victory of American Aircraft is not alone speed . . . or firing power. Vital is its all-around dependability. ★ Back of every success in the air are the decisions of men who must sit in anticipation of action. ★ Comfort must give body relaxation so that mental effort is free to do the right thing at the right time. ★ Engineers and officials design the seating for these men with comfort in mind. ★ Skilled craftsmen at our plant translate these designs into dependable seating for the pilot, the gunner, the radio operator and the observer. ★ American aircraft is thus more vital, more dependable in the fight for victory.

THE GENERAL FIREPROOFING COMPANY

YOUNGSTOWN - OHIO

AVIATION, June, 1942

Dear Pop:



Even an old Maltese Flycatcher like
you would pay your eyes at the other
birds putting together this time.
Let me tell you, they're doing
some great work in our front lines.
The best time is right now, right now,
the best time is righting galloping
you over now.

And that goes for what they do for
us off duty, too! You thin we're
idle because we get just outside of camp,
but we get exercise and everything.
And Pop, you can get something to eat
that won't cost you a cent's pay!

Now, the Army isn't running these.
The USO is. And most of the other
charity groups are stuck to becoming
just another lot of little things. And
now we give the money to the USO
and they give the money to the USO.

But, Pop, you know what's happened
since then. Days've been stretching
into eons. Last year there was
just one USO in the country. This
year there'll be 4 million and the
USO needs a lot more dough to serve
that many men—around \$5,000,000
bucks I figure.

Now, Pop, I know you worked with what
you could get. And now it's time
you could help. If you could dig up
the old sack wrench. Maybe you could
get some of the other tools in the
neighborhood (see ad, pg. 549).

It will mean an awful lot to the
soldiers in camp all over the country.
They're getting a lot of mail. Some
folks are breaking them up. And
Pop, an old soldier like you knows
they're mighty hard feelings for a
fellow to bear. See what you can
do, hot, Pop!

Bill

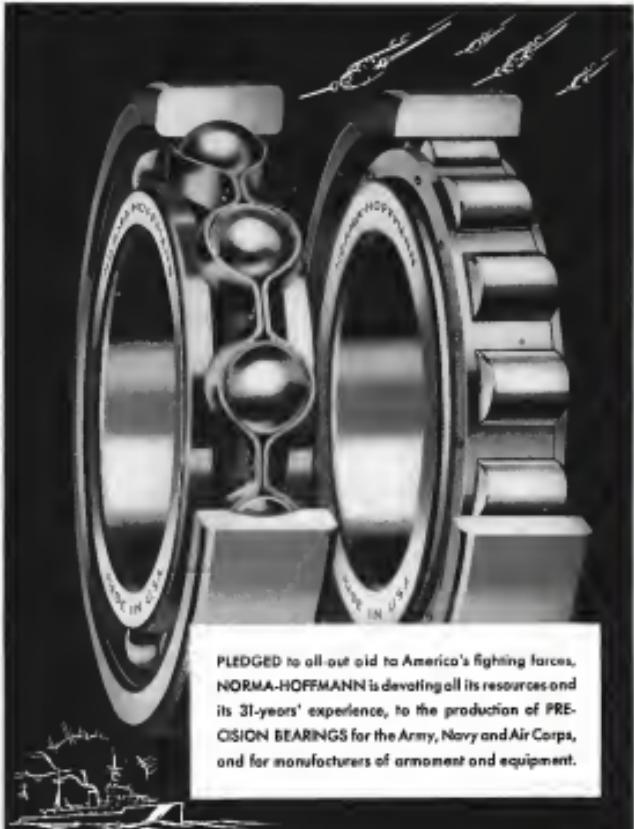
GIVE TO THE
U S O

Send your contribution to your local USO Committee or to National Headquarters,
1220 Madison Avenue, New York, N. Y.

THIS SPACE CONTRIBUTED BY THE **B4** CORPORATION

AVIATION, June, 1942

47



PLEDGED to all-out aid to America's fighting forces, NORMA-HOFFMANN is devoting all its resources and its 31-years' experience, to the production of PRECISION BEARINGS for the Army, Navy and Air Corps, and for manufacturers of armament and equipment.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.
BALL, ROLLER AND THRUST BEARINGS • FOUNDED 1911

Capogold Single Ream Set	Microream Sharp Counterbores	Capogold Offset Ream Set
Crown Flashed Seven Flush Sets	Extreme Precision Set Bits	Capogold Square Set
Precision Flush Bits	Know how! <p>Production schedules that "couldn't be met" are exceeded—records broken, then broken again. This has excited us and they're getting...this kind of work—a production war—won where we have the know-how!</p> <p>On the scale of the trade, Aero Tool is proud of its position as precision producer. Tools—tools—developments of precision production. Tools—tools—delivered through distributorship to distributor—cooperation with the creative industry. Aero Tool, Inc., has the know-how!</p> <p>A 32-page catalog, detailing the tools planned for the main and many other Aero Tool products, is now available.</p> <p>AERO TOOL CO. CUTFORGED AVIATION TOOLS MFG. TOOL COMPANY • 125 WEST 45TH STREET, NEW YORK, NEW YORK, CALIFORNIA</p>	Crown Tools
Sect. Router Bit Set	Brazed and Threaded Drill Adapters	Cermetech Cutters
Rock Counterbores and Spacers	Capogold Double End and Probes	Capogold Seven Drill Sets

EDO FLOAT GEAR
STANDARD THE WORLD OVER

EDO AIRCRAFT CORPORATION
402 SECOND STREET, COVINGTON, W. Va.
Contractors to the U. S. Navy, U. S. Air Force
and Foreign Air Forces

"The Eyes of the Navy"

The parts finisher, the assembly machine, the instrument expert, the maintenance men . . . they're all specialists on the work they understand. There's no question that the files they use should be "specialists," too—*right for the job to be done.*

Nicholson has followed the filing problems and file needs of the aviation industry with particular interest, has determined to meet the laboratory and assembly needs of the aircraft industry. Some of the Nicholson or Black Diamond Special Purpose Files are shown here. Illustrations of some other specialities can be had by simply check individual characteristics. Nevertheless, we bring out the differences with unmistakable evidence!

Using Nicholson or Black Diamond Files brings out a further Nicholson point of merit. A great deal is to their dependable craftsmanship. One or a hundred thousand files, Nicholson's quality, care and results will always prove the case. Watched by trained hands, good work is assured! Twelve perfect files in every dozen in the Nicholson guarantee behind the service of your mill-supply house.

ANNE THOROUGHGOOD is the Special Purpose File shown in Item 1. **BLACK DIAMOND** is shown in Item 2. **For Dia Cutters**—4. **For Heavy**—5. **Aluminum Edge**—6. **Long Angle Lathe File**, 7. **Shear Thread**—8. **for general and smooth finishing of soft metals and alloys**—9.

NICHOLSON FILE CO., PINEBROOK, N. J., N. Y., A. L. C. L. C. F. Co., Fort Lee, N. J.

NICHOLSON FILES
FOR EVERY PURPOSE

The Ears of a Nation



A call to action in Fighter, Observer, or Bomber must be heard. Sensitive, reliable Radio Phones are essential.

Murdock Radio Phones have been the "scientific ears" of this nation in peace—in war—since 1904.

Precision built to scientific exactness.

Murdock
RADIO PHONES

Serving the Cause of Victory

Murdock Manufacturing Co.,
Chelsea, Mass.

AVIATION June, 1942



**It takes more than a whistle
to start production**



THE OUTPUT OF MEN AND MACHINES DEPENDS ON PAPER WORK ROUTINES

The faster machine and the clever workman are helpless until paper work routines have brought right instructions, right materials and right tools to the job. Every delay and every mistake is a drag on production and a waste in costs.

In the paper work routines of production and allied activities, Addressograph-Multigraph methods make procedures simpler, and coordinate functions from the purchasing of materials to shipping of finished products. They save time, eliminate errors, prevent waste, speed output and protect costs. They start the wheels and keep unhampered production going.

USERS OF OUR PRODUCTS are entitled to the services of our Methods Department. It will help to extend the use of their equipment in Purchasing, Stockkeeping, Production, Marketing, Shipping, Billing, Collecting, Distributing and all key operations of business. To those who are interested in up-to-date information on better methods it is available on request, without charge.

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Addressograph-Multigraph Methods
SAVE BRAIN HOURS AND HAND HOURS

AVIATION June, 1942

SAFEGUARDING WAR INDUSTRIES

THE staying quality of Bunting Brass Bearings assures the greater measure of precision, wear resistance and long life required of machines today, and guarantees the continued operation of the machine tools, electric motors and industrial equipment so vital to the nation's war effort.

Completely finished, ready for assembly, Bunting Brass Standardized Bearings facilitate economical manufacture and provide quick, easy maintenance for practically all machines. They also are readily adapted to many unusual bearing applications. Ask your wholesaler or write The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.



BRONZE BUSHINGS - BEARINGS
PRECISION BRONZE BARS

© 1943 by Bunting Brass Standardized Bearings and Precision Brass Bars. Bunting Brass Bushings and Precision Brass Bars. New varieties have just arrived.

AVIATION June 1943

MAN-HOURS were reduced to one-half by hand threading rivets except each day from hours of Martin factories. Now, between work, manual riveting was costly, inefficient.

MACHINE-MINUTES replacement hours, working crews at Martin's mechanical riveter, developed by Martin, operating at high speed, does work more accurately in a fraction of previous time.



LITTLE GADGETS DO A big JOB

in accelerating Martin production

Typical of the many small devices developed by Martin to save production time, is the Martin mechanical rivet-setter. This ingenious device takes the necessitation of rivets swept daily from factory floors and separates them according to diameter, head shape, and shank length. Operating at high speed, the Martin rivet-setter saves much time when compared to tedious, inefficient hand sorting.

Such things as rivet-savers, while individually of minor importance, take an enormous significance when multiplied a thousandfold. In every department of Martin

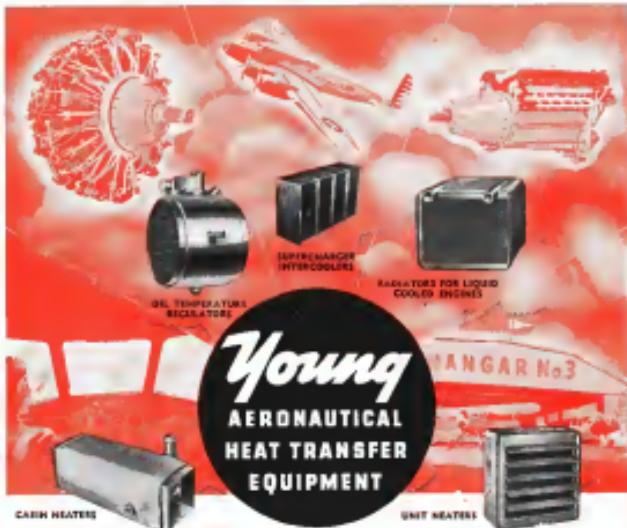
plants, from engineering to assembly, major time-saving methods yield an impressive total of man-hours saved. By constantly studying and improving every operation, however small, Martin is saving time and increasing output for Victory.

The Glenn L. Martin Company, Baltimore, Md., U.S.A.

Martin
AIRCRAFT
Builders of Destrucible Aircraft Engines



AVIATION June 1942



YOUNG aeronautical heat transfer equipment is being specified for American fighting aircraft. Aviation designers and engineers have confidence in YOUNG'S ability to build rugged, dependable heat transfer units to the most exacting specifications. More than a quarter-century of experience in designing and manufacturing specialized heat transfer equipment stands back of YOUNG aircraft products. For example, the aluminum supercharger intercoolers originally developed by YOUNG for the Douglas B-17 Flying Fortress, and modern, ruggedized aero-coolers, engine jackets, cooling radiators, engine warming devices, cabin heaters, heat control elements for air conditioning, etc., and many especially designed heat transfer units for military aircraft... are products of YOUNG research, engineering and manufacturing facilities. Consult with YOUNG engineers about your particular heat transfer requirements. There is no obligation.

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HEAT TRANSFER PRODUCTS

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SHIELD COAT • YOUNG FIBER

*Shall I
take
that job
offered me
today?*



*Shall I
train for
a career
in
aviation?*

The best way to answer these questions is to consider this question—"Where do I want to be in the aviation industry...one year...two years...five years from now?

Trained men! That's the real need of the aviation industry today. And the demand for trained men in the future is obvious in view of the expansion policies of the industry.

If you want a training that will really qualify you for an aviation career when you are ready to apply for a position, you will start that training now at Boeing School of Aeronautics.

Boeing School has a world-wide reputation for comprehensive technical training; its graduates are holding responsible positions today in more than 100 aeronautical concerns.

Before you take that job—before you sign up for a "quicker" course in some branch of aeronautics—you owe it to yourself to investigate the career courses of Boeing School of Aeronautics.

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Grads
Make Good!**

Mail this coupon today.

You will receive complete information regarding the many career courses, faculty, and equipment of Boeing School of Aeronautics. The next classes start August 5, October 10, and January 5, 1942.

Boeing School of Aeronautics
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Anchorage, California

Gentlemen: Please send me more information concerning the above and concerning the following:

Name _____

Age _____

Sex _____

Age _____

<



The Motor That Made the Compass Dizzy

**HOW G-E MOTOR ENGINEERS HELPED
SOLVE ANOTHER DESIGN PROBLEM**

ONE of war customers had designed a precision timed device and a special motor to operate it. The device was to be mounted on a spinning gun, and its operation synchronized with the firing. The motors proved unsatisfactory until the guns were mounted on airplanes. Then when the motors were operated, the pilot's engineers in the compass and other navigation equipment were affected—the plane "threw out of control."

What was to be done? Were all the tools, materials, and plant to be scrapped? It was decided to put the problem up to G-E Engineers.

Within two days, original layouts were made where given the required operating details to prepare drawings that would take standard G-E motor parts. At the same time, we began to build sample motors. Within ten days, we submitted operating samples that met all specifications.

The new motor is smaller and lighter, and has no effect on the instruments. It is made up of standard



parts which are produced in large quantities and in short time. Most important of all—the motor is in production.

This is one example of how General Electric engineers can help save you time and money on motors. Motors that would take standard G-E motor parts. At the same time, we began to build sample motors. Within ten days, we submitted operating samples that met all specifications.

General Electric Co., Schenectady, N. Y.

A few of Navy G-E Motors Specifically Designed for Aircraft



GENERAL ELECTRIC

The advertisement also appeared in:
NEW YORK TIMES
CLEVELAND PRESS
CHICAGO TRIBUNE
DETROIT FREE PRESS
WILMINGTON STAR

You Expected to Read This NEXT YEAR!

Industry after industry is hastening its promise as America's war production sets new world's records . . . Management, labor, W. P. B., Army, Navy, the Maritime Commission and other government departments are cooperating to make next year's headlines come true THIS year.

In World War I, the Kaiser saved America manpower. In World War II, Hitler is even more fearful of our rapid transition from peace to war production . . . He has reason to be afraid.

Practically every factor is exceeding quota on wartime gas parts.

Spark plug manufacturers are setting new speed records in machine gas production.

The heavy-transportation industry is making giant strides for big guns at a faster rate than all the Axis powers combined.

In this industry, men who used to make locomotives and tractors are changing "Too Little and too Late" to read "Too Much and too Soon," from the enemy's viewpoint.

Starting just a few months ago, with a hole of blueprints and a knowledge of how to build such things as railroad cars, powerplants and tanks, the heavy-transportation industry is turning out mobile artillery that will shake the earth in mass than a littered mine.

The story of how this industry passed the army service a significance which should be understood and remembered.

The significance is that America has solved the problem of exchanging production techniques between quiescent industries. This process never so sensitively in peacetime. War gave it prominence.

OVER



Eagles In The Sky . . .

THE eagles on your dollars keep the "Eagles" in the sky. A pledge to buy War Bonds regularly is your pledge to see America through to victory!

Consolidated Aircraft Corporation
Member, Aircraft War Production Council, Inc.
SAN DIEGO - CALIFORNIA

AVIATION, June, 1942



Consolidated Aircraft Corporation's new airplane plant — expansion first by the Austin Company.

KEYNOTE in the construction of this vast plane factory has been "Controlled Conditions." Light, sound, atmosphere . . . all are controlled to provide uniform working and equipment conditions 24 hours per day, 365 days per year.

Worthington's part in this tremendous undertaking has been the furnishing of the refrigerating equipment for the air conditioning system, the fire pumps, and additional pumps for water circulation.

In manufacturing and installing the equipment, it has been our privilege to work closely with the executives and engineers of The Austin Company, and we are pleased to congratulate their organization on this noteworthy achievement.

TODAY, practically the entire output of Worthington's five plants flows directly into the war production program . . . for the Army and Navy thousands, as essential equipment for the munitions, steel, petroleum, chemical, and many other industries, and as the basic equipment of such vital public services as power, water supply, and sanitation, for concentrations of war workers.

It is significant that Worthington's ability to produce many and varied items of important equipment now is the result of having maintained, through past years of prosperity and depression, an organization which is armed and tool'd to do its job when called upon in peace or war.

For the solution of war production problems in air conditioning, power generation and transmission, liquid transfer and metering, and construction, Worthington equipment is now available. Our engineers are ready to assist in planning plant expansion or conversion.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY

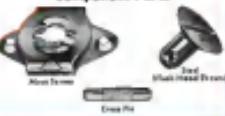
AVIATION, June, 1942

Designed for Easier, Quicker Application...and for greater efficiency in the attachment of removable parts!

SHAKEPROOF COWL FASTENERS

(PAT. APPLIED FOR)

Only Three Standard Component Parts



No Stress Hazard

Because stresses are absorbed throughout the base of the resilient main spring, strains are removed from the primary structure, particularly shear stresses on the aluminum attaching rivets. Consequently, the isolators may also be used in such materials as phenolic, etc.

Atrial Fibrillation

When used as mounted or loose sheets, the stud float easily (or slides) in the unclipped position so to the leading cross pin stop. This allows for removal of excess or sealing without binding.



Compact Size and Light Weight

The fastener design incorporates dual springing and balanced stresses between parts, enabling exceptionally high loads to be handled by fasteners of relatively small size. This permits installation closer to a corner or edge and assists in eliminating unnecessary weight.



Quick-Green-Box

Special adapters can be supplied to permit the installation of Shakespeare Cowl Fosters where cowl pipes have already been tested for gain and base fenders.

Compensation for Variation in Sheet Thickness

The upper bearing hedge in the sealant
matrix provides automatic take-up
to compensate for the usual range of per-
formance tolerances on about thicknes



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Your Copy
TODAY!**



From all Great Patriotic Assembly
gathered—by their mutual

The new 28 page Catalog AD-1 thoroughly explains the features and advantages of Shakeproof Cowl Fasteners. It also contains an illustrated test report on the physical properties of the fastener, along with detailed ordering information. Offered to aircraft engineers, buyers and production men without charge.

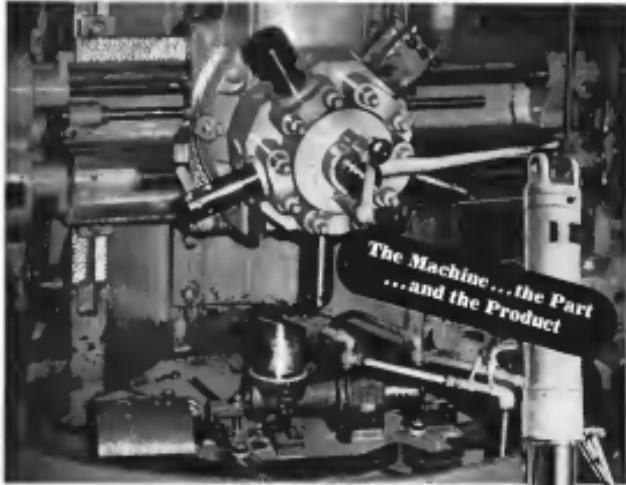
AVIATION  DIVISION

SHAKEPROOF Inc.
fastening Headquarters

Department of Mathematics Graduate Program at Boston College, Chestnut Hill, MA 02442-3860 USA

Classifications and their analysis

• COMMUNICATIONS • DRIVING AND PLANNING/ROUTE • PERSONNEL TRAINING • COMMERCIAL TRAINING
• DRIVER MAINTENANCE • BASIC AND EQUIPMENT SKILLS • TEAM FAIRNESS • INDIVIDUAL TRAINING



This photograph shows one of the many new precision metal working machines and dies the product of a leading plant only as a result of the addition of this type of machine production capacity to their already modern landing gear unit has been increased by 100 per cent.

Carefulness here comes home to roost on flying field and flight deck!

Maintaining the necessary high degree of accuracy in early speeded up production of landing-gear equipment for heavy aircraft calls for care beyond usual standards. Care in machine-tool selection. Care in fixture design. Care in close-dimension techniques. Care in assembly and test. Never in its service life would a heavy motor truck axle spindle, for instance, be called upon to "soak up" such an impact shock as a giant bomber's landing gear must take in its daily stride. Hence the care above mentioned....which "comes home to roost" in thousands of happy landings.

BENDIX PRODUCTS DIVISION
OF BENDIX AVIATION CORPORATION

Bendix LANDING-GEAR EQUIPMENT

AIR PLANE WHEELS AND BRAKES • PNEUMATIC SHOCK STRUTS
SWIVELABLE AND STEERABLE TAIL-KNUCKLES • PILOT SEATS

Someday the War Will End

"THIS WILL BE A LONG WAR AND A HARD WAR," said the President of the United States in a recent talk. He was right. In the first few months of its aggressions beginning we have spent more money than the rest of the entire bill for participation in that highly touted conflict mentioned. The World War II. We have suffered greater losses in naval personnel than the total for the previous history of our Navy. We have passed through a almost unknown series of reverses and our most brilliant performances necessarily have been delaying actions.

In spite of all this there is not one among us who even entertains a thought of anything but final victory. Our chief problems are concerned with attainment of that victory in the shortest possible time with the least amount of unnecessary bloodshed.

On the home front there is much tangible cause for concern. Material shortages and unfriendly pressures have failed to stifle the rising tide of aircraft production. We have reached the point where you can stand for a few minutes at the end of a sunbaked lawn and actually see planes roar out into the sunshine—a brief test flight and on they go for destinations unknown. It is true that there are many places to send them on all the continents but at last they are beginning to concentrate in those places and slowly their pressure is being felt by our enemies. And with all this we are not on the threshold of even greater manufacturing novelties.

Our successes in the battle of production have not been gained without headaches and heartaches, and there are more of them to come. Even as this is written there are many plants unable to operate at the fullness of their newly created capacity because of lack of certain materials. Some of these manufacturers are greatly concerned about the morale of their workers because of production slowdowns due to shortages. Some are facing the possibility of layoffs, and when you lay off men in those times, they don't wait around for you to take them on again. It would be well for those among our leaders who are concerned with priorities to consider these facts carefully if they wish the aircraft industry to continue to perform wonders.

In certain areas it is not unlikely that transportation of workers may emerge as the next serious of all logistic tasks. This problem will not be satisfactorily solved by

such spectacular expedients as kermodes for workers or 150 passenger use model buses. In the first place, you can't jounce people around in uncomfortable vehicles and expect them to perform at their top efficiency in precious manufacturing work. In the second place, the large capacity vehicle demands an over purpose because it requires the use of a maximum loading point some distance from the workers' home. The only satisfactory solution at the problem will be found in the use of some smaller type vehicle which will provide greater flexibility and less roundabout travel mileage between workers' homes and the factories.

Although these problems are pressing, there are others equally serious and there will be others at present unforeseen. But there is one that can be foreseen, and that is being sorely neglected in the thinking of too many of us. It is the problem of post-war readjustment.

Some of us feel that total war means total extinction, no present problems and that philosophy is laudable. Some of us have lost the criticism of our military leaders if we dared to think of anything beyond winning the war. But the final victory will be hollow indeed if we are not prepared to assume the tremendous responsibility of reconstruction. The devastation wrought by this present conflict will be far greater and will reach farther than the loss of any of the 880 major conflicts of recorded history. But after the world has been won consider we whom carry on. It is an important part of patriotism to do some thinking now about the future. This is the duty of every man and woman engaged in any phase of the war effort, be it civil or military. If we do not put aside a portion of our thinking now for post-war planning we will be faced with a future calamity that will make this terrible war seem mild by comparison.

John E. Harle

AMERICA AT WAR

"We are not going to lose Australia," promises Brett, as the Jap is slowed in his push to the South. Meanwhile, antipodal forces of the United Nations pulverize Nazi arms plants in RAF blasts at the Continent.

LIEUT.-GEN. GEORGE M. BRETT, United States Air Force Commander, Australia, says that Australia can hold its own little despite the Japanese but "we are not going to lose this country."

American and Australian planes are on the air off the coast looking for Japanese, says John Milligan, former Australian Minister for Air.

Sixty or even more planes now fly there where very last Communiqué was written that Japanese air and surface forces have been almost if not completely stopped on the waters of North Australia. There is no longer an expectation of fear of loss of that big island, as Washington so obscurely

says now, as the fixed low wall never northward instead of southward. America, and here that wall depends, says General Brett, will be getting sufficient time to train to fight and hold offensives. It is a war of attrition—a war to hold, not to win or to expand.

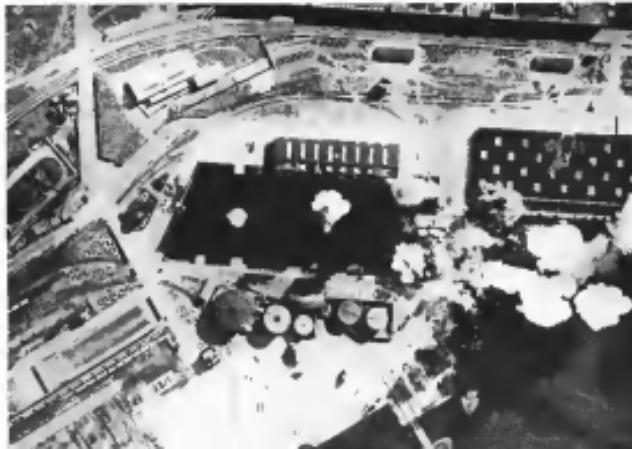
General Brett goes when he is a fair estimate of the quality of Japanese airplanes when he said that 300 American planes are worth 600 Japanese planes. This is taken not merely as a boastful remark but as a considered observation. Even at that, if we have to put up 300 airplanes for every 200, even or eight thousand miles away from home, it's no small share.

Most observers are still surprised at the showing the

The newest shot caught British bombs landing on docks and buildings at the height of a major daylight raid on La Plaine, German base on

occupied France. Note system of bomb stakes. Bombs increasing the marked area.

U.S. AIR FORCE



Japanese are making in the air. When you consider that the little yellow men have scarcely any industrial creative power, save having invented nothing in the whole point from egg beaters to superlatives, one must admit they are doing a first rate job of adapting other people's ideas to develop well in their needs and their ambitions.

Definitely, in the absence of any official report on the number of Japanese bombers, one may guess, as stated in the British Manchester Guardian, with an attempt to show the Flying Bombs produced by the Japanese 300 and 14,000 a year, rather than about 5000, as most experts believe. His argument is not very convincing.

Still more about the Japanese effort: the Army and Navy Division says it has reported that Japanese army forces are inferior to aerial forces. Most of the enemy bombers are of the two engine type, with a maximum ceiling. The new-type bombers are still inferior to similar type American planes. But bombers were more effective on points usually located to approach within 10,000 ft. of the target. Virtually all Japanese fighter planes are inferior to American planes.

REB on the war in the East, it begins to look as if the historian, trying to highlight 1941 in the Second World War, will put down some account of the result of the British and American bombing of Berlin and Hamburg. These facts may already have forced the development of heavy war planes at a greatly sharp angle. The United States Navy has not said whether or not it is laying down more battleships.

Black comes to Europe and Britain's announcement that the German battleship *Gneisenau*, *Zyklonbord* and the heavy cruiser *Friedrich Eberhard* have been hunted down with one cameras, and discovered to be badly damaged and definitely out of Hitler's spring pack. This comes in confirmation reports of Hitler's spring pack. This comes in confirmation reports of Hitler's spring pack. The United States Navy has not said whether or not it is laying down more battleships.

(Turn to page 200)

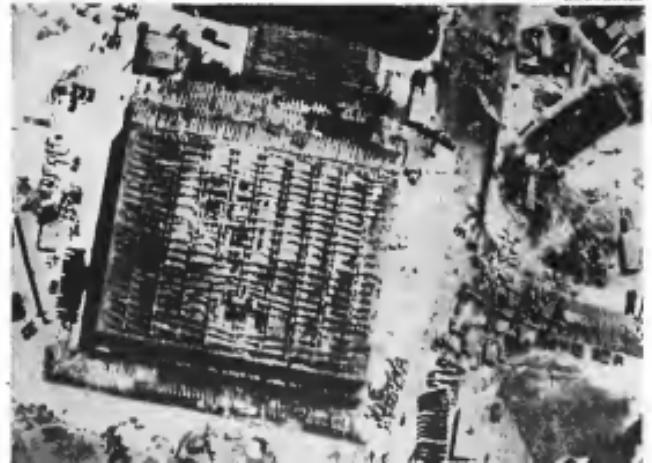
After four successive nights of devastating raids by the RAF, the British pilot at the Gremmelsheim part of Siegburg presented this



RAF pilot Major G. S. Morris' Consolidated "Catalina" plane was shot down over the air coastally opposite Australia's coastline and listing for the day. Blasted remains of the Australian Air Force crew holding a "Catalina" after a failed flight.

black report on a plane just raided from London. Shrapnel holes in the factory roof and windows of planes the directly accessible.

U.S. AIR FORCE



Women in Slacks Speed Plane Production

No longer is their doubt that women can "take it" in our factories. Aviation's experience proves they are actually increasing the output in the greatest production effort the world has known.

By DON WHARTON



UPI Photo

These all-right dollies and swiveling Aeronautic carts will take their planes or the weekly issue of *Flying* right off the assembly line at Ford's huge Willow Run bomber plant.

Women have long played a large part in actual production work in aircraft plants of major aircraft companies in the United States. In

Ford's girls put the fuselage together as examples in this plant shop. Women prove better than men at certain jobs.

UPI Washington Photo



OUR 1943 production goals call for 10,360,000 workers in war factories in addition to 5,000,000 already employed, according to Sullen Heffman, labor director of the War Production Board. That means that actions of women must help to "take it" in our factories.

The actions of America's women respond to this call. How well will they do their part toward keeping America Free? The achievements of women in warplants in the aviation industry give a typical and inspiring answer. While Washington has less backlog among registrating women, our aircraft plants have put them to work in essential jobs.

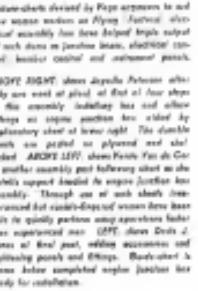
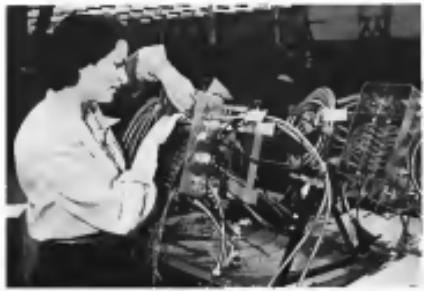
Not much more than a year ago, there were only 1,000 women in aircraft plants, even for a few maintenance and inspectors. Even as late as Pearl Harbor the industry employed only a few hundred women. Today, Mrs. Morris is among many of them now to make bombers. But the entire industry had lined up the Brewster T. Consolidated has 3,500 women reporting. For every day goes by, more and more women are added to the list. But the total number has not been fully accounted for by a woman's hand. According to the industry, last month more than 15,000 women in aircraft plants were working.

Value has begun taking many women, especially those in the younger, 18-to-25 age group, from the post office, to machine shops, flour and laundry as disk passers, sewing machines, cut-out seers. Where the work is repetitive, foremen universally report increased efficiency. By June that figure will probably

be tripled. By the year's end it is expected to reach 180,000—and keep on rising. From plant to plant, women are working on every type of plane from light trainers to the heaviest four-engined bombers.

The little industrial revolution began in Los Angeles where Valair makes tractors and peasant traps. Early in 1941—several weeks before WPA asked aircraft plants to experiment with women workers—Valair hired 25, put them to work as cleaners and radio sets assembler, stringing wires and fitting out junction boxes. These patients were relegated to other work on April 1 but the production of aircraft was so urgent that they were brought back again on March 21 in order to prevent cracks about April Fools' Day. As these weeks the Valair experiment proved a success, units produced per week had increased, some going up 30 per cent, some even 50 percent. In addition, the women had improved rates to increase their output to keep pace.

Value has begun taking many women, especially those in the younger, 18-to-25 age group, from the post office, to machine shops, flour and laundry as disk passers, sewing machines, cut-out seers. Where the work is repetitive, foremen universally report increased efficiency. By June that figure will probably



come. One peaks to a girl pulling a man of weight through a long tight tube—15 miles against her male predecessor's half-hour. Another foreman shows you a woman who has just completed a job which took little longer than a hour—another woman here has a brother—comes a sister here for that time from two hours down to 30 min. Value was the first company to use a powered conveyor assembly line. A fuselage starts down that line, passes stations on which girls install rivets, controls, instruments, panels and so on. It begins as a bare skeleton, the frame and emerges a completed fuselage, ready to be attached to tail boom wings—and another to route this same fuselages.

In the past five months Value's experience has been matched by plant after plant. At Vega's attack bomber

factory, one foreman with 28 percent of his crew women was asked what percentage he considered ideal for his department. "One hundred percent," he said. Many foremen who recruited the training of women in their departments are still longing for more. "If less tempo and fatigue are in factories," one said me, "women are as good as men."

Virtually every aircraft plant has efficient women riveting teams—one riveting, the other holding. Gleason Martin made extensive tests in light aircraft teams, trying a man riveter with a woman helper, a woman riveter with a man helper, and so on, until he found a woman helper. All manufacturers studied. When North American召集ed women for men in the rudder department production went up 20 percent. One of the women has a child at

home and a husband in the Navy. She operates a home machine shop used to turn a lathe. "She handles it," her boss was says, "like a man does." And that's reason we note it.¹ At Motor Marine's Dallas plant a girl who used to work in a beauty parlor finds 4,000 metal chips a day rate a machine—3,000 more than man had averaged.

At Northrop, which has had 400 women in 30 days, there was one job only two men in the plant could do. For a time the foremen tried to break it in a team. The women, however, who had the know-how would not let the men do it. They did it in a week. At Lockheed, whose experiments use girls, we should transcribe a man's laudatory statement: "A girl is just as neat in her job as a man is."

(Turn to page 318)

Tactics and Unorthodox Aircraft

Britain relies mainly on conventional design for the bulk of her military aircraft strength. However, certain technical innovations have been made possible with telling results upon adoption of unorthodox design features

By MAJOR
OLIVER STEWART
Editor of Aeromarines

From Staff Photo



AVIATION PHOTO

Above: A Hurricane power-operated fighter at His Majesty's "Ops" (Operations) Room. One of the unorthodox design features exhibited by the British resulting in considerable tactical advantages. Operating flights were always out of the air when these planes drove straight and cut loose from the sole.

Left: The Westland "Spartan" liaison plane is used for observation work with its very slow flying speed. It is equipped for photo-dropping, magnetic mine laying, and even bombing. Its remarkable flexibility is reflected by its top speed of 125 mph.



The Spitfire was looked upon by many people as the most outstandingly brilliant aircraft of the big British armada, and which is listed to out-top only the heavy bombers. Yet also to the medium bombers, it is an example of a bold unorthodox piece of design work.

No other country in the world thought it possible to produce a power-operated aircraft. Yet Britain has gone forward with that component, developed it both for clandestine operations and for high-speed operations, and finally brought it to the stage of full efficiency.

At first many different theories were held about the method of operating such a aircraft, and one of the early British Patent inventors was so annoyed that the engine would not turn the propeller that he would stand above the engine and spin the propeller by running his legs. Thus, by spinning the gas in the right place, power would be obtained in the front and the propeller would turn to the right.

Other methods employed the hand grip similar to that found in some motorcycles [but all these methods were quickly ruled out under stress of war] and the power-operated gas burner is now incorporated in fast machines of perfectly normal conventional design built by conventional methods. At the outbreak of war in September 1939,

Britain Was First With Power-Operated Turbines

But although a conventional machine-operated power-operated unit had been devised to play the leading part in war there are common when unorthodox designs or unconventional methods of power-operated units have come with surprisingly unusual results.

If the operations of the Royal Air Force are studied, it will be seen that they are their resource mainly to steady development of aircraft and auxiliary equipment, but also to some extent to striking original thinking and to the introduction of unorthodox features.

The power-operated gas burner, which

has been the beginning, a feature of the big British armada, and which is listed to out-top only the heavy bombers, yet also to the medium bombers, is an example of a bold unorthodox piece of design work.

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outbreak of war in September 1939,

British aircraft and has been responsible more than anything else for enabling Britain's bigger machines to break off fighter attacks.

RAF's Most Successful Bomber

Here there is one example of original unorthodox thinking brought to a highly successful conclusion in war. It is entitled, so far as the untrained eye is concerned, by the graphic construction of the Vickers-Armstrong Wellington. This form of construction has frequently been described and it is not necessary here to repeat the details. In effect it is a form of construction of two-section single-wing monoplane which themselves give the aircraft not only the strength but also its shape. In other words, the graphic construction places the strength of the machine where it is needed most—the surface of the aerodynamic shapes. In fact it contrasts with more conventional construction where the strength is imparted through girders and struts which are made to support or fasten and which do nothing to support to their own aerodynamic shape.

The Wellington has a right claim to be one of the most outstandingly brilliant aircraft of the whole war. It has served in many theaters and under difficult conditions. It has been placed on most of the very long range routes where the RAF has gone and has successfully given the British the failed satisfaction. Certainly it is probably the most outstanding of all.

Why RAF Fighting Misses The Advantage

In assessing the success achieved by the RAF fighters we must be attributed more to the unorthodox tactical thinking than to any speed, flight or maneuver. It was decided long before the war started that British fighters, whether they be the power of fighters heavier than any other fighters in the world. The consequence was that guns were packed into them to an extent never before thought possible. Our other point is worth noting, that these guns were packed in such a way as to enable them to be used without any synchronization or interlocking gear. This is a matter of great importance to the pilot who has to clear the field except by the amateur blades.

The Vickers-Armstrong "Spartan" had eight guns mounted in its wings all fixed to fire forward in the line of flight and all outside the drift swept by the aircraft. Similarly, the Hawker Hurricane had eight guns mounted in its wings. The latter version of the Hurricane has to clear the drift machine gun, so, alternatively, fire 20 mm. rounds.

This immediately leads us over

for single-seat fighters must be looked upon as unorthodox. It was not thought by anyone in Germany or any other country that it was possible to build fighter planes with a single seat having advantages over the others. The plane has been pushed even further in the Bristol Beaufighter which carries four 20 mm. rounds and six machine-guns.

When we turn to other classes of aircraft we find some notable unorthodoxies, such as among these the Westland Lysander Army Co-operation machine. This unique plane has had a long history of life and has been the source of bitter humor than any other fighters in the world. The consequence was that guns were packed into them to an extent never before thought possible. Our other point is worth noting, that these guns were packed in such a way as to enable them to be used without any synchronization or interlocking gear. This is a matter of great importance to the pilot who has to clear the field except by the amateur blades.

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This immediately leads us over



COURTESY PHOTO

Super five power is provided in these "Wellingtons" fitted with either 20 mm. canons or twelve machine-guns mounted in the wings and flying outside the propeller diameter.

the wings, enable him to be presented at lower speeds than would otherwise be possible.

The Lysander is also a masterpiece of unusual planning. It packs into its framework a vast quantity of equipment. Both wing armament has the obvious purpose of silencing the pilot in just a short time downrange. Lynden Lane has been used for an enormous variety of different tasks including message dropping and picking up and the dropping of containers for parachuting troops in isolated places.

Unorthodox Aircocks

These aircraft are instances of unusual departures from ordinary technique. They have played a vital part in RAF operations from the start of the war and they show that although the scope is restricted there still is scope for the unorthodox and for the original. Most important of all, the RAF has taken into service the United States single-seat fighter of unusual unorthodox design, the Bell Aerocar. This will be watched with unusual interest for many people believe that it may prove the way for useful future developments like engine installation behind the pilot, extension of drift shaft to a tail-surface propeller through which an automatic ram-air is blown, and triple landing gear as all features now undergoing the rigorous trials of actual service conditions.



Photograph courtesy Hayes Industries, Inc. SH
Timken Bearing Equipped Landing-wheel shown in test.



Typical application of
Timken Bearings in an
airplane landing wheel.

After Victory—
a big upswing in
commercial aviation. Get
ready for it now; redesign
your equipment and
include more Timken
Bearings.

Many of the lessons learned in the fiery air
of war will be of tremendous value in post-
victory aviation.

For example, a new machine has been
developed for testing airplane landing
wheels designed for use on military planes
—from the smallest fighters to the largest
bombers and troop transports.

This machine is shown in the photograph. It
can duplicate any airplane landing condition as regards speed, load,
shock and braking for any size of wheel and any weight of plane.

The tester consists essentially of a large, heavy, durable wheel, the
weight of which can be varied as required, turned by an electric motor
at any pre-determined speed up to 100 miles per hour. The landing
wheel to be tested is mounted midway on a hydraulically-operated
movable arm as shown in the photograph.

In making the test, the heavy free drum is set in motion, and as soon
as it attains the pre-determined speed (representing the landing speed
of the plane), the landing wheel under test is brought into forcible con-
tact with it. The instant contact is made, the brake is applied to the
landing wheel, which then must bring the drum to a full stop in 10
seconds. This procedure must be repeated 100 times before the landing
wheel is accepted by the Army Air Forces.

Despite the terrific strain to which every part of the wheel—including
the bearings—is subjected during this test, every Timken Bearing so
far has come through in perfect condition.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



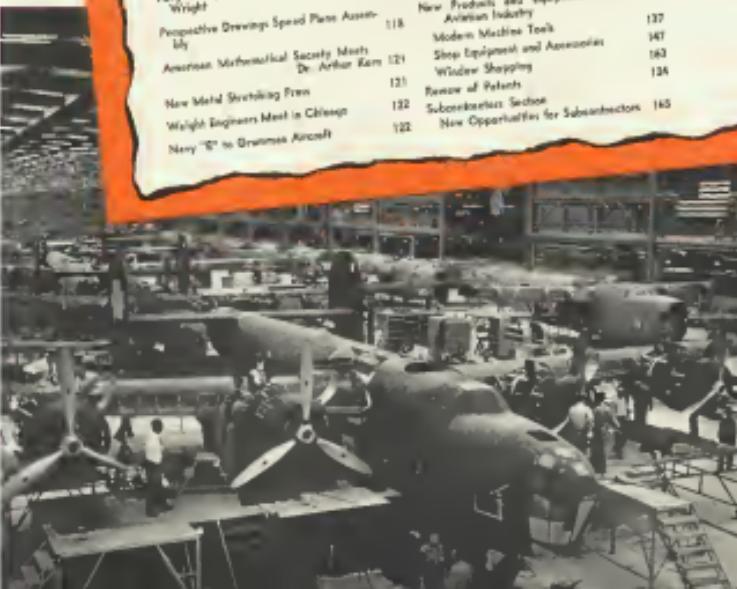
TIMKEN
TAPERED ROLLER BEARINGS

MANUFACTURING Section of AVIATION

PRODUCTION • DESIGN • RESEARCH • ENGINEERING

IN THIS SECTION

Forging-Up-Drawing Frickman Anderson	82	Welding Gas Conservation Impulsive	125
Mens Producing the A-20 Bomber	John D. Warner	AIRCRAFTS Sketch Book of Design Detail	126
Efficient Machine Loading	Max Shugar	Mass bomb racks of the Short Stirling	126
Improved Solutions of Remote Control	Herkert Cherie	Bulkheads of the YS-44-A half	128
Problems	John Sessa	Structure of engine's enclosure on Mar-	129
Working Transparent Plastic, II	John Sessa	arsaultfitt Me 110	129
Production: Beaters of Headwings	Ferry Anderson	Catering of Metal Hercules aircraft	129
Forged Cylinder Head Developed by	Wright	Fuselage Interior of the Short Stirling	131
Precise Drawings Speed Plane Assem-	ly	Boiler on Tail Grinding and Cutting	132
American Mathematical Society Meets	Dr. Arthur Kam	Hydraulic Test Regulator	132
New Metal Stretching Press	John Sessa	New Products and Equipment for the	137
Weight Engineers Meet in Chicago	Navy '47 to Grumman Aircraft	Aviation Industry	137
Subcontractor Section		Modern Machine Tools	147
New Opportunities for Subcontractors		Shop Equipment and Accessories	163
		Window Shopping	163
		Review of Patents	164





FORMING-BY-DRAWING

A revolutionary new mass-production process for producing compound curved surfaces in sheet metals, particularly adapted to the large skin panel requirements of the aircraft industry.

By FROHMAN ANDERSON, President, Anderson Aircraft, Inc.

THE "FORMING-BY-DRAWING" process is a new technique in metal forming. This process is distinguished from rolling, stamping or stretching methods in that the forming action places longitudinal drawing forces applied to a moving sheet while it moves at constant speed.

Inconceivable forming and drawing could be accomplished by applying this action very wide basic dimensions. The number of different compound curved shapes that may be ob-

tained by calculated adjustments from a single set of these forming elements is infinite, as contrasted with the single shape obtained from the sheet of the simple hydraulic or stretch press or the power hammer.

Using tubular frames, and by using pulleys, adjustment of the elements is made for a permanent shape on simple and compound while the sheet may be moved in either production work

A single-cut, to run a new shape, requires little loss of time since there

are several sets of adjustable elements which are quickly interchangeable on the forming machine.

Autodynamically speaking, the most efficient aircraft skin panels have in layout characteristics that render them difficult or impossible to fabricate by conventional methods. The chief reason are the limited use of costly or unusual materials and the spring back difficulties in the pressing or stretching skin low curves.

The Anderson Forming-by-Drawing

machines produce in a single stroke the shallow elongated compound curve or a cross shape parts prepared to cover large surface areas with a single sheet, with uniform nose projection quality and speed. Besides the smoother, continuous surface obtained with large sheets, the elimination of a high percent of waste results in labor savings and substantial cost-reduction of structural

sheeting, drop hammers, large stamping and hydraulic presses, and lost tooling expense, idle material substitution and reduced operating current output can readily be appreciated.

The application of the process also contributes substantially to higher speed through better formation of internal panels and improved availability of rigs. Simple methods of construction and reduction in structural weight also contribute.

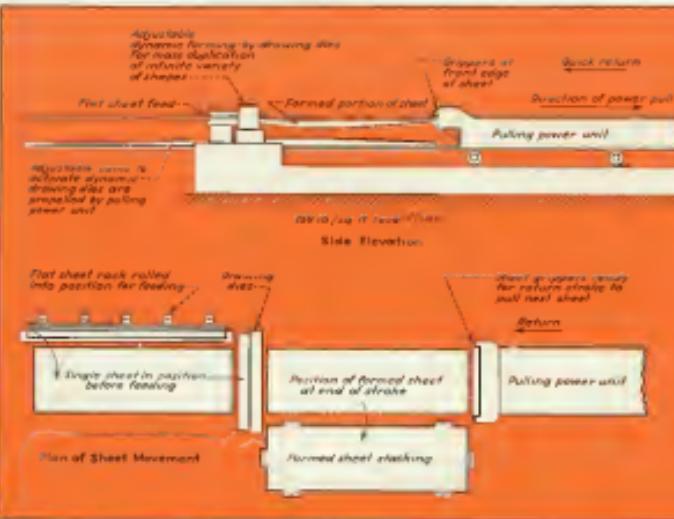
There is no stopping to intermediate, in some cases panels may be trimmed to size before forming.

Various panels can be arranged so as to be formed in a single large sheet by nesting in tandem, single or multiple rows for the maximum utilization of space and maximum saving of time and labor.

Sheets required by change in design are efficiently changed by reversing the sheet direction.

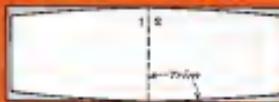
Some aircraft drawings demand with this process, resulting they need no longer be restricted in the use of small, narrow panels, have revised their designs for the use of large panels with few joints, rivets and reinforcements resulting in savings of weight, material and production time.

The machine is self-centering. Scratches and irregularities in the sheet are compensated as much as possible in the form of straight true lines and shallow compound curves, on a square sheet, since



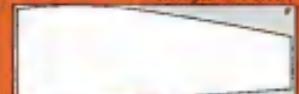
Inverted drawing dies limit distance and prevent collapse of apparatus of Anderson process

These compound curves with concave sides can be addressed with the American method. Special punches can be formed to any desired geometry.



This like panel can be formed to your sheet and then cut in back, resulting in a cutting of material.

Simplified flat check



The panel illustrates how making of wide-leg drivers is incomplete for this and other small openings.



Perimeter of irregular shape, can make two or three or more cuts to approximate dimensions from these formed and intersected with little waste.



Separate flat sheet

Driver, the panel can be driven to shape in a single step and later separated by shearing as indicated by dashed line.

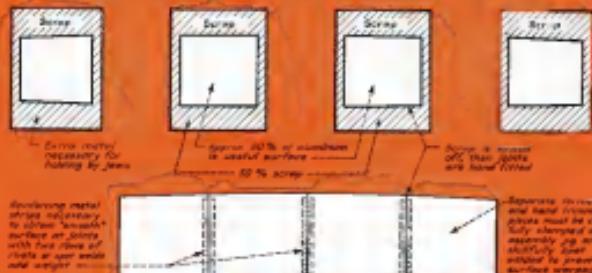


A complex dieless forming-hydroforming tool completely fits into a truck or trailer. The forming-hydroforming machine can form local flaps or panel strength are twisted with no bending or stretching are necessary.

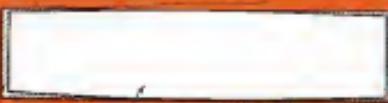


Sheet duplication over working surface of panel after forming provides the increased metal condition for correct cracking handling, crimping, padding, shearing and ultimate the forming and re-forming of the panel in the future.

Sheet key slot made in free unclipped places requiring four forming dies



Sheet key slot formed in one place by the forming process.



Driver punch and
dielectric insulating
surface in one dimension

Up to 10% increase occurs. A 100-ton press hydro-forming a panel have reduced in preparing blanks, bending, stretching, lifting, shearing, crimping & spot welding. Weight & materials reduced by eliminating drivers & driving areas of the panel. A 100-ton press hydro-forming a panel has been reduced by one-third compared to 100-ton dies. Maximum weight savings were obtained from relatively warpage removal of the large panels and maximum reduction in number of parts, cost of assembly and practically no reduction in thickness, since the hydro-forming process is a cold-forming, and there are almost uniformly throughout the sheet.

ten. Changes in gauge thickness is equal steady, but the width may be freely distributed than by the other methods.

The process has been used with various success with basic metals stainless steel, monel, magnesium, brass and aluminum alloys of various degrees of hardness. The surface of the metal is not impaired by the action of the forming elements. This is true even with 24ST Alstal. The present machines have been shown ranging from 600 lb. to 125 ton in thickness.

The machine itself consists of four major complementary units. The first is the forming-hydro-forming machine through which the flat sheet passes and emerges as a curved shape. The second is the power unit which grasps one end of the sheet and pulls it through the working elements of the Forming-hydro-forming machine.

Machine Is Flexible

These elements can be used and oriented in identical cycles, as desired, so that the exact duplication of formed sheets is obtained, improving the performance of whelk, panels, however, etc., or reproducing shapes. Besides pulling the sheet, the power unit actuates the various working elements of the Forming-hydro-forming machine by timer and synchronized systems.

Advantages and interdependencies of the forming and shearing elements are many with the combining and shearing was easily made using conventional stampings or drop hammer dies and forming made dies for stretching or shearing necessary for each individual shape, as well as the heavy, unnecessary of such tools and their storage.

With the adjustable modulus, however, only tabulated records need be filed away for reference on future designs.

tion of orders, and that is one of the major reasons for failures in the setting of time and finding costs to the ultimate manufacturer.

In a continuous process, this method reproduces shapes with exact dimension and desired stiffness, providing ideal conditions for compact stacking, handling, storing, packing, shipping and ultimately the trimming and assembly of the panel to the customer.

References

Sheet-forming flat sheet into one piece, the machine can perform on already formed compound sheet about into an entirely different shape. At times, when an engineering change has caused the elevation of formed panels in tool-production, the pre-formed sheets may be re-drawn into a new shape, without the necessity of reworking.

The present machine can accommodate metal sheets up to width up to 60 in. or any length up to 24 ft. and thicknesses from .005 to .125 in. A 30 ft. stroke may be attained, however, with additional air cylinders.

The width, length, gauge and properties of material and the shapes are determining factors for speed of forming, but set to face panels per minute in an approximate average. While the process is not yet in full-scale production in the automotive industry, it is also applicable to the formation of frame members and other parts in which a modification of surface area through drawing or stretching of one part of the material more than the other is required.

The process is covered by pending patent application, and a multitude of uses for it are being investigated in a research program of the developing company.



FIG. A. These surfaces are part of an order for the panels the sheet of the Gordini-Mitsubishi automobile. Note the current compound formed punch as each stamping station will accept four diepositions and 60. FIG. B. Preliminarily, consists of the process with a series of engine casting housed by its means. After drawing, sections which subsequently repeat pigs as assemblies without further treatment. FIG. C. Feed into the adjustable "forming-hydro-forming" dies. FIG. D. Power unit at the pulling mechanism which draws sheet through forming dies. FIG. E. Expanding dies of the dies through which sheet goes down. FIG. F. Shears are for pulling and shear sheet or sheet thickness and width. It specifies these have sharp and reduce surface roughness of the sheet and of sheet. FIG. G. This is also power for the blank key die of a Morris 1200 which is successfully formed in one pass. Work rapidly of sheet without support of any kind except of work.





Daring the Battle of Britain, when Nazi bombers night after night rained death on London, the British turned to this plane to help repel the attackers. Originally supplied as the "Boston," a medium bomber, its speed, maneuverability and low-carrying capacity were such that the RAF mounted additional guns, called it the "Havoc," and sent it aloft where it proved a deadly efficient night fighter. In large numbers, it now serves the British in both versions.

MASS PRODUCING

The "How'ds-done" of Douglas Aircraft's magnificent achievement in rolling out the A-20's on its mechanized assembly lines at ever-increasing volume.

WITH "Speed and More Speed" the battle cry of anti-Axis production lines today, a goodly part of the answer is being literally "run" on the Douglas Aircraft Company's A-20 production lines. There the ringing of bell means A-20 strike bombers from the stock room to the flight-test range, as regularly as the clock ticks off the minutes. And at a rate of production far greater

than ever before of "before the new, mechanized method was perfected."

Thus A-20's are no low-powered, light-weight planes, either. They are, in fact, all-metal fighting craft whose British versions, known as "Avro and Miles," have already claimed the Aces in Libya, knocked the Axis-operated fortresses of the salient of Paris, and stalked Nazi raiders returning from the

PIR 3 hydraulic press the largest five of these currently in use in the industry, form massive parts under the pressure of 200,000 pounds to the square inch of sheet metal by the Gossen process. FIG. 2 illustrates apparent sizes of hydraulic presses in FIG. 1 are shown here. The size is given to make the press fit fully headed with sheet and

sheet metal and covered with "rubber blankets" supporting the pressure of the steel rollers and which acts as a bearing oil. On the side of the last, the bearing area is arranged thus not about metal and covering them with the rubber blanket it will then be ready to go under the press when one of the other three shafts comes out.



black sky over London, as night fighters and bombers.

Brought in a crew of three, the U.S. Army Air Force's A-20 is chosen as attack bomber, but is in fact so multi-purposeful, versatile, parking a remarkable load at high speed and maneuverability, that it can be used as a fighter, whether as a "pursuit" or as a "bomber." It is also used as a transport, T-20, in the U.S., or Bostons in Britain, it is a formidable combat plane being produced in formidable numbers as one of the most rugged, mechanized assembly lines in use anywhere.

Engineered under the direction of Arthur E. Raymond, vice-president in charge of engineering of all Douglas plants, the first version of the A-20 type was originally designed by the U.S. Army Air Corps' Bureau of Aircraft. Its original production method was "con-

ventional" and consisted of a cone of thousands of oil Douglas plates into innumerable hobbles until the team of Presidents Donald W. Douglas, F. W. Glavis, vice-president in charge of manufacturing, T. B. Coulter and J. D. Thompson, plant head, experts, and many others of the world Douglas plants, were able to determine the best way to accomplish maximum output and minimum loss of production engineering, tool engineering, and maximum labor department.

Out of that came teams as

several hours that are original or design as well suited to their purpose that adaptations are being made while in other places, throughout the nation, the mechanized line of production of the A-20 was one of the first that had ample time to prove its worth.

Before the 30 bombers are delivered,

or even needed for final assembly of

the plane thousands of man hours of

great facilities, personnel, forming plates by the new well-known "Gossen" process, developed here at Douglas by Harry Gossen, manager of the Santa Monica plant, transformed each blank plate and formed parts. These, in thousands, are transported through the sun and chips, are recognized through "stamps" and "names" of the plates, by electric sensors, pass on regular schedules.

A Steady Stream of Salvage

And from the presses, hobs, cutters, shearing machines and sanders goes a steady stream of "salvage" that is sorted, pressed and ready to handle tools, or loaded for shipment to producing plants where it is used to clean up scrap metal. And, still at a saving in materials and money that is immeasurable and important to the war effort and the paper's pocketbooks. In fact, hundreds of thousands of pounds worth millions of dollars are saved annually.

As in a number of other major airplane manufacturers, we prepare breakdown drawings of the innumerable required for each type of plane. The 800 revolutions accompanying this test will give us certain portions of the manufacturing problem arranged sequentially, the assembly might be said to consist of four main areas: (1) pressing simultaneously with others, and some following in sequence. Although it doesn't actually "happen" in this order, these are steps are: (1) Assembly of the fuselage, (2) assembling and joining outer wing sections, (3) installing of landing gear, (4) mounting of the Wright Cyclone engine, (5) addition of the tail assembly, and (6) attachment of the outer wing sections.

Today, however, at the completion of "salvage" along the assembly lines, the production department of the engineering division has placed there are, perhaps, damage, similar to now accompanying this test, for the

THE A-20 BOMBERS

By JOHN D. WEAVER
Technical Engineer, Douglas Aircraft Co.

version" in that it was moved from 22-40-kg metal body it was capable of holding on its own gas. But, as orders were piled upon orders, it became apparent that a faster and more efficient method, with greater precision, mechanization and more specialization by assembly line workers, could be evolved. The solution at our "second" assembly line

would have already gone into the making of thousands of separate parts, early on the request, that constitute the completed plane. These have been cleaned, painted, and assembled per order, and later were welded together, each in its own way, at its proper time and place, and stored as it can be conveniently transported to that place where it will be fused into the whole.

FIG. 3. Material conversion at Douglas: a major division of the assembly lines uses hundreds of thousands of pounds of scrap metal every week in making of shells. These castings pass through the heat picking up scrap metal. FIG. 4. These tubes come from machinery and rolling operations especially suited to aircraft plates again. In the form of

small ingots of various metals and alloys. The heat keeps the metal when scrap ingots, because separation of mixed scrap metal is difficult, sometimes impossible. Shells that do not melt if permitted to do so may take alternate scrap numbers of smaller scrap.



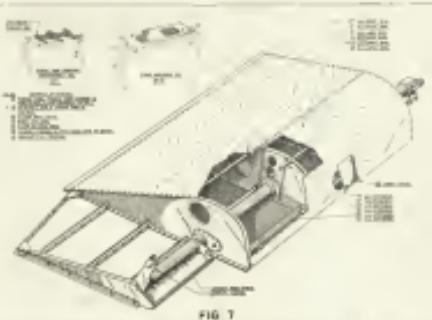


FIG. 7

FIG. 7 At each working position or station, and throughout downstream processing stages, we believe economies of time and effort can be had from the use of temporary fixtures.

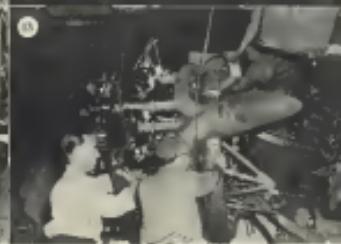
generation of one craftsmen. By having fixtures at all times, a clear, very understandable guide, each man at least knows what is to be done and the best way to do it. In fact, the only way to do it.

Another example of this "streamlining" of the job is our method of constructing wing assemblies, as far as is possible, in

FIG. 8 At each working position or station, and throughout downstream processing stages, we believe economies of time and effort can be had from the use of temporary fixtures. FIG. 8. After the stack has been repositioned, balanced and positioned into correct location, it is made ready by the workers to be disassembled for the smaller and easier FIG. 9. An A-20 can be easily "from fixtures" because the last fixture, the main rear external stringer, is in the same position and of the same height above the aircraft floor as all who work on it. FIG. 9. An end view of the A-20 fuselage half-shells assembly stage. When these two shells have joined, the half-shells will be lifted from these pins by overhead cranes and will proceed, without the fixture, to the fixture down the line as stations can be front loaded.



AVIATION, June, 1942



the same position they will have on the completed ship. Take the case of the A-20 as an example. It is balanced on a vertical line where it grows, step-by-step, from its foundation pins to its final suspension, while being carried along, whereas, if conventional working heights, in the same position, it will have on the plane. Because our methods make it easy to do this, it appears that the plant's limits to expand in size whatever it is doing, why it has to be done where it was, and today pride in doing the job well, honor and delay are minimized.

And just as the same, fixtures and other minor necessities are concentrated on one working line, so, too, are the major wing sections, shown in another assembly photograph. Likewise, the front of the fuselage has no pins, rods with rollers rapidly taking shape, to cause off of the rear end, a completed inner wing section.

We at Douglas take considerable pride in the development and innovations of the Glaser process; the bush-crushing process developed here and turned over to the industry, in exterior material conservation, and are moving strenuously

to exceed all expectations, high as they are, for our portion of the war plane production program. But, we are proud of the streamlined production line techniques developed here, and elsewhere in the aircraft industry.

To build A-20 fuselages we adopted the "stacked or multi-shell" plan, whereby either left half-shells are balanced, suspended and, when complete, with all required installations, are moved into a completed fuselage. This method offered means to construct each half shell, fit it speedily and healthily with all related installations, with minimum working on both sides of each half-shell simultaneously, and with practically no crowding into such crowded places.

The fuselage is carried on two steel rails, one over the floor and one short nose just directly above the lower rail mounted on a sturdy framework of wood and steel that also carries electric and compressed air outlets, light fixtures, tool boxes, and such other items as such stations require. Between these rails, and running across the fuselage, are great rectangular frames of welded, wrought steel tubing. Within these frames or girders are the attachment brackets and lashing pins by means of which brackets and struts and other parts of the fuselage structure are held in place until they are locked firmly together by rivets.

Starting empty, but directly from a

CRADLE OF PRECISION

Many of the world's most important contributions to aviation aircraft instruments have been created on the Holloman Air Force Base. The Holloman technical laboratories are notable examples. Holloman engineers have, in fact, often created or refined almost every type of precision aircraft instrument.

These places here are but a few of the most familiar vapor-state factors open

to the world today to test, which at top
end of Holloman design.

These engineers and many others
make up the only idea-stimulating in-
stitute of Holloman engineers in the
great research laboratories now available
in the United States at war today.

And to the commanding, and generous
people there will make the world a
world of great numbers.

HOLLMAN
AIRCRAFT INSTRUMENTS
Division of
SOLID STATE EQUIPMENT
KANSAS CITY • MEMPHIS • BIRMINGHAM
DETROIT • LOS ANGELES

market for which it has been thoroughly
checked for perfect alignment, the "pig"
pops up latches and struts are in the
test working position, gets more of them in
the seat, and continues to measure
existing stations where the skin is
clamped on and later released.

Because of the half-shell method
watermen can sit and are situated
at irregular angles, they don't take sides
of the seat and start loose. The watermen
team is individually welded together
with each other. Tools such as
drills or rivet guns, are permanently
suspended as needed convenient to their
post at all times, eliminating the time frequently
lost in shuttling them in and out
of tool cradles as shells change, and
floating miles of trailer guns of equipment
waiting to return to older tools.

Already such position is attained
by different locking features that
hold it in place until a man gets in.
In most cases, watermen hold the
watermen, but in some instances at
his side, at the edge of the seat but
never in it, are the exact number of
parts and rivets, screws, bolts, or clamps
required to attach them. These were
delivered, conveniently stored on their
selected site, by the electric truck that
supplies that particular station.

When the selected site for said pos-
tions is attained, the "pig" is moved,
and the center of the seat is
forward and rearward, under power
supplied by an electric track. Each move
makes room for another pig to start
down the assembly line. Each has come
back to the station point by way of a
return track that extends from the main
platform end to the master pig at the
steering end.

Providing this feature "pig" half
shell is another on which "right halves"
are being continuously assembled.
The two halves are joined peripherally
both halves retaining the "end of the
line," or apparently the half-way
point in the same time. Then, with
latches and struts and skin can
properly mounted, and rivet calculations
set in place, half halves are separated
from their respective pigs for the final

Ground crews pull up the half
shells, set them a quarter turn, and de-
rivet them in opposite sides, that are
a movement which is done quickly,
but hold the half-shells with three com-

partments, forcing each other, ready to be
joined. On these follow the half-shells
containing on down the line, but now
using rubbers instead of end-use as
they started. Tension calculations are
completed in this position, at several
stations, and the two halves are then
joined and simply seated.

Released of these half-shell heads,
centered over a pre-set gun, are delivered
to the gunner, who then turns the gun
over to him for a complete check of their
accuracy, stopping on one if necessary,
or for repairs or adjustments that may
be needed.

The completed and passed fireleads
then requires its own manufacturing
team. These will assemble another,
larger lead line of normal design. On this "wing track" wing sections
are joined to form subassemblies that are
joined to a wingbox pig. When the
assembly is completed, the subassemblies
are removed from the wing track assembly
and enter the main track assembly.

The track, developed also at Holloman
and now adapted likewise in the air
factory, holds the outer wing section,
eights and lefts, respectively, about six
inches length, at a maximum working
height. At each station additional parts
are joined until, when each assembly
is completed, for example, if it is ready to be
joined by center of the wing, the position
is marked on the frame.

At the factory and outer wing ins-
tances are joined, leading gear is at-
tached, and then engine and tail as-
sembly are set in place. The rapidly
shifting ship is now riding down un-
til the assembly line stops when a large
spray booth has been created. As it
passes through this booth it requires de-
contaminated fluid. This continues to
run on to the skin, to the skin assembly.

At the end of the line, the first comp-
lete outer wings are attached and the
circular completed plane is attached
to one of two final assembly tracks
where it rolls by gravity, on its own
steerable front wheel and tail, to a
assigned position, to the far end where
it leaves for a completed A-38-type
bonnet, ready for inclusion flight.

This final assembly line is referred to
as the only one that furnishes the final
airplane, carrying both manpower and
machined power. "A" is clearly obvi-

ous provides tremendous power for the
movement of each plane from station
to station during final assembly. Simple
but effective broken step and fold track
plans at each station, an ample track,
multiple baysides, and other assemblies
are added.

Here, too, numerous tests are made,
among them that of the hydrostatic
tests, which are performed on the basis
of weight, speed, and fold checks by the U.S.
Army Air Forces inspectors.

On each production line there, the
A-38 and then B-52 and B-57 aircraft
are built and given the major
power, speed, and maneuverability
that prompted Gen. Gen. Henry
H. Arnold, chief of the United States
Army Air Forces, to win Douglas his
plaque rewards, as follows:

"Douglas Bombers have surprised us
again and again. First B-17s, piloted
by Army crews, won a prize a day
in flight race over the following month on the
West coast of America or North Amer-
ica. During all these targets, they out-
lasted up to them. Team up with
American made fighters planes, they then
bagged four German percent ships."

Perhaps, before this can be publicized,
800 ft. of West Section will be demon-
strating to the Axis that long is "no
its half-shell" is no handicap.

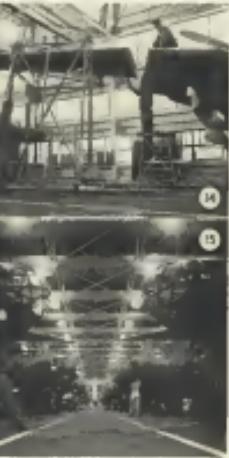


FIG. 10. Gulls wing carried on a specially designed boat is lifted to the correct height and rolled across piles for joining to the other wing. After this operation, the dog cart will do its own rear wheel and shims, as partly shown the final assembly line FIG. 11. Fully completed A-38 aircraft goes final assembly line. Note that at this point the upper shell is not yet fitted with either of the two panels under the fuselage. It may then knock while the third panel is squared at the steerable nose wheel. This final assembly line is notable in that it is a gravity feed line. The airplanes rolling down at their own weight along the track which is inclined a few degrees, and the planes being dropped readily and easily when desired by a single slide thereby saving both manpower and manpower.

**ONE
EVERY EIGHT
MINUTES!**

THROUGHOUT during standard days of the North Atlantic over the pale fringed skies of the Pacific... American aircraft are carrying the war to the enemy thousands of miles from our shores. And these are but the vanguard of the 60,000 warplanes the nation is pledged to put in the air this year!

America must make good this promise, at what ever cost in red and sweat and sacrifice. It means the aircraft industry must produce a complete airplane every eight minutes, every hour, day and night, seven days a week. That each plane must go thousands of precious bush-pins from hundreds of doctors — the greatest contribution of any nation ever attempted in all time!

To Goodyear Aircraft has been assigned the duty of building ultra-modern—super-wing, tail and fuselage with flight control surfaces, form and other parts for several types of fighters, as well as assault and heavy bombers. This number one war effort is requiring all the engineering skill, facilities and resources Goodyear has invested in its thirty years oferonautical experience.

And beyond that, the men and women at Goodyear Aircraft have promised the nation, through their Joint Labor Management Committee, to do their utmost in helping the aircraft industry maintain the *plus* *over-eights*-a-month schedule. For all of us here know that we, too, are soldiers in the Battle of America; that our American freedom, our model of living, all our hope for the future depend upon that ceaseless winning command of the air.

GOOD YEAR AIRCRAFT

AVIATION June 1942



Aeronautics Department
THE GOOD YEAR TIRE & RUBBER COMPANY, INC.

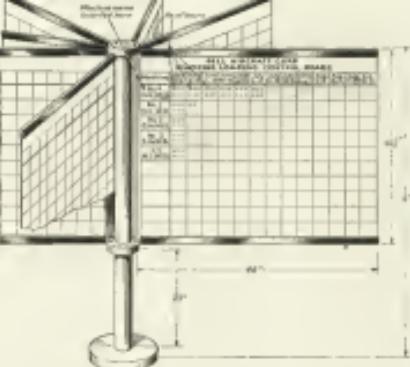


AVIATION, June 1942

MACHINERY LOADING CONTROL BOARD AT BELL AIRCRAFT—The complete setup consists of a number of boards painted black and mounted vertically behind glass and mounted on a base. Each board is about one-half page in size.

Cost items concern only one kind of job where all cutting operations are to be based off total cost are as one board, all suitable saving measures etc.

This system permits individual machines to be identified in a group of machines consisting of any number, any by function by a color coding indicator and identified by name in an individual machine.



Efficient Machine Loading

"Just simple arithmetic," Bell Aircraft engineers call it, but their "simple" methods produce more airplanes in less time.

By MAX STUPAR
Coordinator of Production, Bell Aircraft Corp.

When all types of machinery and tools are at a premium, failure to achieve maximum efficiency from each is a little short of heresy—every idle machine is working for Hitler. Highly & Co., Bell Aircraft's production engineers have worked out a system which naturally results in reducing lead and off-time of machines to the available minimum.

To ASPIRE to maintaining a smooth flow of production and to insure the maximum efficiency in the utilization of machine tools and fixtures, Bell Aircraft engineers have developed a revolutionized system of shop studies and machine loading which gives surprising results.

The system evolved has paid off in an important part in the remarkable reduction in set-up time required to set up standard machines. When a new part is released from the design department to the production planning engineers, the engineering department is called in to work out a standard time estimate for each process based on past experience with similar work.

Knowing the number of pieces required, when they must be finished, and the standard time required to set up the machine tools, a comparison is made by the engineers, reference is made to the machine loading board. The shows for studies ahead the actual lead in man-

hours, and number of shifts scheduled for each machine.

If with the maximum possible utilization of machine available it would be impossible to meet the established schedule, the standard engineers will then begin work to have a decision as to how machine work could be concentrated outside or how much new machinery must be acquired.

Better Work Subcontracted

Generally, only the easiest jobs are sent outside, knowing full well that we are better able to cope with the rough cut jobs in our own shop and visual delays involved in sending drawings of complex parts. It is, of course, possible due to location that more complete control of work in our own shop.

It is especially important to keep as many work shops as possible using certain raw materials. Since delivery of specific quantities are under strict control, we cannot risk shipment damage through mistakes or false warehouse reports.

In this connection it is interesting to note that a relatively inefficient method of production from the standpoint of time consumed is sometimes reflected in preference in the most efficient if it happens that the one method more completely satisfies both critical job requirements.

As soon as a piece starts through the shop, the time study engineers go to work on the actual time study data as submitted with the original drawing. This data is established for all machine operations and subcontracting or tool selection can be worked out with extreme accuracy.

(Turn to page 366)

The problem of braising a $\frac{1}{4}$ " threaded flange into a completely closed 20 gauge sheet steel container was solved by Induction Heating.

Induction, energized from a Model 803 Thermanic Induction Generator, were placed directly over the flange and caused heating of the flange and a small area of the sheet steel container.

With this process it was possible to perform three braises simultaneously, in 35 seconds.

A series of Data Sheets completely covering the subject of Induction Heating will be issued shortly. Ask for today for free information and consultation.

A pre-plated ring of Easy-Fin Silver Alloy melted and flowed to form a perfect, air-tight joint.

This is only one of the many problems solved by Thermanic in the "War for Survival". The same engineering staff that solved this problem are available to you.

INDUCTION HEATING CORPORATION

Designers-Builders-Of Thermanic Heat Treating Equipment

389 LAFAYETTE STREET, NEW YORK CITY, N.Y.

The Finest that Money Can Buy

BONNEY Tu Type Wrenches Will Save Time in Production—Maintenance—Service



"TIME is Short" and every effort must be made to save time in producing and servicing vital equipment.

Bonney TuType Wrenches, because of their unique design, are time-savers. Combining an open end and box wrench in the same tool, each with the same size opening, prevents using the end most applicable to the job at hand.

Drop forged of Bessemer Steel and heat treated their entire length, Bonney TuType Wrenches are made with sixteen different size openings ranging from $\frac{3}{16}$ " to $1\frac{1}{8}$ " with lengths varying from 5" to 21", depending upon the size of the opening.

Handles are thin and oval-shaped, providing a firm, comfortable grip and, because of their length, extreme leverage.

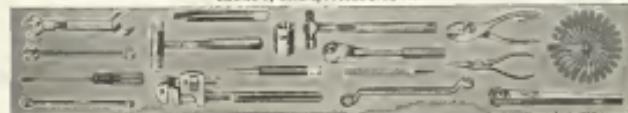
Openings in the open end are angled at 15° for efficiency, while the box end is offset at 15° to provide clearance.

Available as single wrenches or in complete sets to meet individual needs. Your local jobber will be glad to give you complete information—or write for catalog listing the full range of sizes and showing the complete line of Bonney Tools for Production—Maintenance—and Service.

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

In Canada—Grey-Bonney Tool Co., Ltd., Toronto

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AVIATION June 1942

Improved Solutions Of Remote Control Problems

As size and performance of aircraft increases, problems attendant upon weight and complexity of controls and control couplings multiply rapidly. Light and compact electrically operated control units provide the answer in many instances.

By HERBERT CHASE

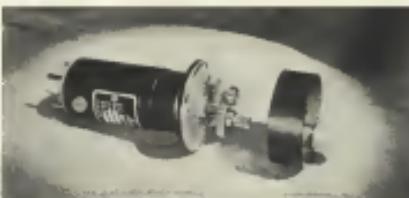
AT THE TIME of writing, both the size and the state-of-the-art increases problems of remote control are compounded. Measures units located at long distances from the pilot and train other control stations have to be powerfully up-armed. Direct mechanical control is often too笨重的 or virtually impossible. Hydraulic methods, though suitable for some purposes, leave the question unanswered since through the possibility that a whole system may be put out of use if fracture or other mishap occurs leakage of sea level.

No single system can be made satisfactorily immune to injury. From ground, of course, but certain forms of electrical controls, usually combined with a servomechanism drive through flexible shafting, can prolong their utility and save finding new applications.

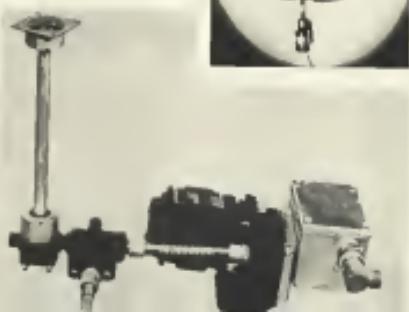
Electrically controlled control units are now available in light weight, compact form and in combination with magnetically operated clutches which connect and disconnect them entirely as may be required. This can be made to satisfy the effect of over-running starters having considerable inertia load, when required, permits of controls within a range of 0 to 360° . The method of disengaging also facilitates the use of limit switches without a heavy fly linkage.

The use of electrical controls is readily made unnecessary, as by a thermostat, for example, but (and this is often highly important) if the automatic device fails to function as intended, a pair of wires in a normally operated switch provides for manual control should the emergency occur.

Where distances are not enormous, it is possible to accomplish the desired control with a flexible shaft running from the control station to the part controlled, as between a control station



ABOVE: Fig. 1. Small servo motor for trap solution equipped with a 20-to-1 gear ratio that unit with a "Pegleg" shaft. The left is the unlocated head of the hinge carrying the pivoting and a slot case in the rear. These shafts are mounted in ball bearings and the receiver end of the slot is shown integral with a flexible shaft. BELOW: Fig. 2. Trap connected through close bearing sleeve shaft and were pivoted into a ring with seven rollers for more little to operate traps in heavier stages. CIRCLING BELOW: Fig. 3. Close view of middle assembly which includes a driving motor with its own gear reduction, two were gear reduction, and, at the bottom left, one of a series of seven links for trap flap suspension, all driven by Walker Torsion flexible shafting.



AVIATION June 1942



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ABOVE: Fig. 4. Experimental test setup with flexible shafting arranged to operate eight aircraft propellers simultaneously. Each propeller is at an angle and connected to its motor and to a larger fixed bearing assembly of its own and a 200-lb. weight which hangs in flight such that the propellers are caused to rotate by the flexible shaft and gear drive. The setup is intended to simulate the operation of four propellers under heavy wind loadings. BELOW: Fig. 5. Typical usage of Gear Drive equipment including a small motor with clutch and gear drive, a right angle drive gear drive, an H-type flexible shaft coupling, a hand wheel and three wave gear reduction blocks. Larger flexible shafts would be used if greater torque or reduced speeds were required.



and a direction finder loop, for example.

Flexible electrical cables and flexible shafts, control systems often require such supplementary units as gear reducers, angle drives, identity from line-shifting, and other permanent parts, or different forms such as are needed for the operation of flaps. All of these and many other related equipment are now in large scale production by Lear Avia, Inc., and are being supplied for use not only in aircraft but for certain ground equipment required by the Air Forces, not to mention other applications.

The lengths of flexible shafting with courage and strength, though supplied by Walker-Torner Company, Inc., have a large number of different roots, some of them made in several sizes, are available and they can be applied to an en-

ormous number of combinations, only a few can be given summarily here.

Holos are furnished in sizes ranging from 2 to 5,000 watts and can be had in speeds up to 34,000 rpm. In addition, the smaller holos, which requires a gear reduction, can be had in ratios of 10 to 1, 15 to 1 and ratios are usually equipped with a self-centered "Panty" disk which is magnetically operated and fitted with a Leslie which can stop the disk within 1,000 sec., according to the makers, from a speed of 3,000 rpm.

When the current is on and the motor is running, the disk is engaged by magnetism, but when the current is off a linkage, a spring drives the driver disk away from the driving disk and causes it against a braking surface, stopping its rotation almost instantaneously, so that it is light and is thus disengaged from the driving disk and remains

The better our threat coast to a stop. The drivers disk is, of course, mounted to be part to be opened and since there is usually a considerable gap between the sleeve and the plate, it drives the latter very smoothly a small fraction of a degree after the clutch disengages. Reengagement is rapid but without shock, so there is a slight momentary slippage between the two disks.

A good idea is to some of the set-ups and of the units which enter into them can be had from the accompanying illustrations. One of the most important features especially applied to these is the flap controls of which several mechanisms are used on large bombers. A typical installation of this type (Fig. 7) includes a driving motor with clutch and gearred head. From the motor case, the drive is through a short length of flexible shaft



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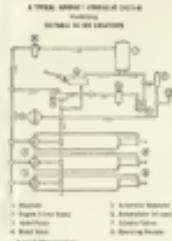
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Using a shearing alloy household frame at the Douglas plant, Quickwork can easily handle the operator to follow irregular outlines with ease.



Quickwork Shear Thinning Brass Sheets at the Douglas Aircraft Plant, Santa Monica, California. Here are being irregular-shaped aluminum alloy wing sections.

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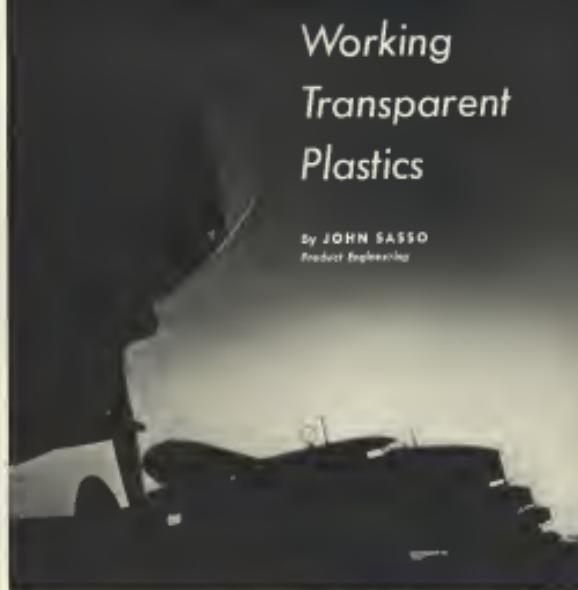


Quickwork Rotary Power Hammer.

AVIATION, June, 1942

Working Transparent Plastics

By JOHN SASSO
Product Engineering



Transparent plastic aircraft canopies of these Goodyear "Warbirds" point the way for industry itself by the stress is only light

PART II—Machining, finishing and repairing of cast acrylic sheets are discussed in this concluding article on the application of transparent plastics to airplane construction. Last month, the methods of forming and joining were described.

THE WORKING QUALITIES of acrylics are similar to those of brass or soft copper and therefore, the usual rules of good machining practice apply in these areas. Cutting edges of the tools should have no ripples and should have a sweeping rather than a cutting action. Tools and work should be held firmly to prevent "chattering." When high speeds are used, the very fine vibration which results can cause tooth and cutter damage, which can be brought to a check by wet cooling and tooling

tolerances of 0.000 in.

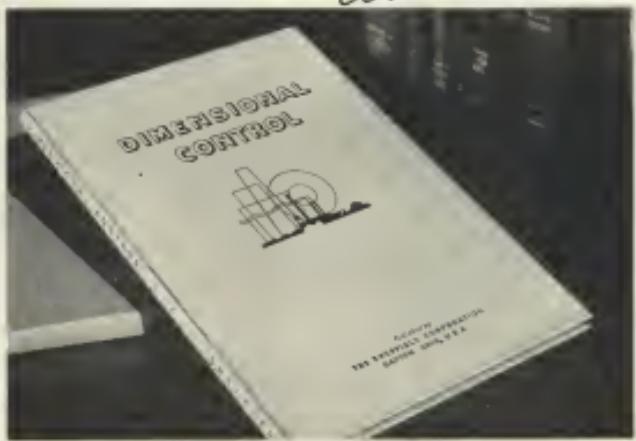
Under planing, acrylics may be set with any of the saws used for wood and metals. Circular, band and jig saws should be moderately fine toothed and should have little "set." For this material (up to 0.150 in.) a standard fast cut-ground rip saw may be used, provided the teeth are sharp enough for accurate teeth and non-clogging tools to be used. Stars should run at 8,000 to 12,000 surface ft. per min.

From the acrylic section to fibers or plateaux, they do not grain or dull the saws. If reasonable care is taken to avoid overheating, no coolant need be used. If a coolant is needed, use water; oil coolant attack the rubber additive used on the masking paper.

When a masked or double-gummed area is to be sanded, it is good practice to sand the masked area first, then sand up into which the section can be fitted. A hand veneer saw can then be used to

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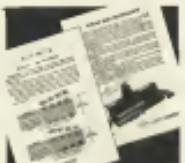
This is a 64-page book carrying 12 illustrations. It is 7½" x 10½" with a special stiff cover and cloth binding—price \$3.50 postage paid. Mail to company today in order to be sure to get your copy. The print order is limited.

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AVIATION, June 1942

than the press accuracy and quickly.
 Lesser tolerances of $\pm .0001$ in can be maintained in using Principles now than under and fast in length, tolerances should be $\pm .0005$ in for larger sections.

Ranking

Routing should run at a high speed, 20,000 to 22,000 rpm, so that the cutter takes a deep cut in the wood, well then not be apt to crack the toe of the cutter. Since the toe plus the depth of the cut equals the thickness of the material, it is not possible in a single routing operation to maintain tolerances on both toe and depth smaller than the thickness tolerances. In short, smaller tolerances usually can be maintained between a wider toe or cap than a narrow one. If both toe and depth are critical, a second routing operation is necessary—click a second routing operation in following out.

Drilling and Trimming

The same end mill and drill used for general work are also used. Better results are obtained, however, if the drill is ground with very little lead.

To prevent chipping and burning, the drill should be held from the hole squarely and straight enough. Moderate speeds and light pressure avoid "grinding" when the drill penetrates. If high speeds are used, a coolant may be required.

Trimming can be done without chipping, care to take to remove the last few thousandths of an inch. The key should be twisted out often to clear the threads off edges.

Routing Principles

Before starting to sand, buff or polish, Principles should be cleaned carefully. The buffing and buffing compounds should be free of dust and grit to avoid scratches on the surface. The function of buffing, sanding or polishing too long or too roughly is to use one spot will generate heat and remove soft, worn material from the face. This effect is more pronounced in the case of formed surfaces, which may shrink back or flatten out if the buffing is kept at hard spots.

No net sand unless it is absolutely necessary. However, if surface imperfections are too deep to be removed by

buffing, use the least newspaper that will remove the imperfections. Buffing with coarse paper or if necessary will only roughen subsequent finishing operations by scratching deeper than the original imperfections.

Usually 210 grit wet or dry paper is an answer as will be required, and it can be used for fine work up to 400 grit or finer paper. Wet the napkin to reduce the heat of friction. Hold a wide area, fast of sanding is required in the small areas, edge-to-edge distinctions or "soft edges" will result in the surface the very light passes.

The same general procedure applies to sanding belts and grinding wheels except that the greater degree of heat generation makes the use of a water or oil coolant doubly important if not absolutely necessary.

Machine Buffing

Good buffing results are obtained on very soft, open types of metals using a bell wheel. Some of the polishing compounds are available wet to help the surface clean so that washing is not necessary. Where these are not used, however,



ABOVE LEFT: North American uses an ordinary hand plane to clean Principles to use. The natural oils in wood and a wheel as strong ABOVE LEFT: Soring Principles on a metal part. A North American worker uses a hand plane to smooth the surface of a formed Principles article before cleaning its dimensions at the job in the foreground. The worker's hands are shown in the picture above right.





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Belden Aircraft WIRE

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wire should follow work step in polishing. Use standard polishing compounds composed of very fine shanks or similar abrasives in combination with wax, talcum, or grease leaders. These compounds are available in various sizes and are used for cleaning neoprene and are available in several grades, each of a different color. The finer grade is as coarse as is required in most cases, but the coarser compounds may also be used.

Buffing should run at about 3,600 rpm with 21 per cent, for example, a 6 in diameter buff should operate at approximately 2,400 rpm.

When most of the scratches have been removed on the first wheel, buff on a wheel to which only buffing has been applied. When an established radius cleaning buff is used, it should operate at 3,200 to 3,500 surface per min.

It is also possible to use a large, broad faced wheel (about 12 to 24 in) in a chamber and rotate it at 3,000 rpm with a feed of 1/4 in. per revolution. This chamber is cut into slots and mounted between face plates. Place talcum as is used with these wheels and a speed of 3,200 to 3,500 surface ft per min. as mentioned. The material is best brought to a high polish on a buff on which no abrasives are allowed to pass.

These cleaning buffers may be of variable chamber 18 in. to 12 in. in diameter. The feed will be 1/4 in. per revolution and the surface will be similar when forward cleaning buffing using 5,000 to 6,000 surface ft per min. No further washing or polishing is required.

The second or rough edges need to a smooth buff finish as described above. To remove sharp, sharp edges if it is advisable to hold the edges to a ground stone or a hard wood block which would be (approximately 1 in. thick) or a wood or steel disk operating at 3,500 surface ft per min. using a paste of water and pumice, magnesium carbide or similar abrasive. Follow the directions for buffing outlined above. It is advisable to buff long edges on all edges and rounded edges. This a dull tool and apparently it is in most cases better to hold the hole to be polished. Right side up, the edge should be equal to the depth of the hole plus 1 in. If the outer surface of the hole is rough, sand strips of coarse wire around the hole, gripping to the slot, and apply a fine grinding compound. When the outer surface is smooth, though dull, sand the rest with a good grade of sand and use the compound described above for fine buffing.

Final Polishing

When buffing equipment is not at hand, a good job always depends, much to Neron, can be supplied by hand to remove scratches and other imperfections. Use a sharp, soft cloth such as soft diaper cloth, imitation chamois, glass



Pulling a formed Plastiglas panel into its position at the nose牛seats of a Douglas plane.

clothing or cutting flannel. Careless should be taken not to rub too long in one place because the metal will become overheated over a fairly wide area. Scratches are often removed by this method.

When the scratches are removed, as considerably reduced, the cleaner should be washed with a damp, soft cloth, and a good emulsion soap should be applied. After the polish has been applied, stony, it should be permitted to dry. Use a few seconds and then rubbed lightly with a dry, soft cloth.

Repairing and Patching

Repairs made under field conditions are at best makeshifts and should not be regarded as ever other than tight. Even when adequate facilities are available, repairing the part may be less expensive than attempting a repair. In general it will be found economical to buff almost all surfaces before applying the patch and to provide enough of the slot and enough lead forward surface. Besides the convenience of cost, it should be borne in mind that even a carefully patched part is not optimally or structurally equal to a new section.

At the first sign of cracking, a hole is cut in the slot as described above and the slot is filled with the hole to be repaired. Right side up, the edge should be equal to the depth of the hole plus 1 in. If the outer surface of the hole is rough, sand strips of coarse wire around the hole, gripping to the slot, and apply a fine grinding compound. When the outer surface is smooth, though dull, sand the rest with a good grade of sand and use the compound described above for fine buffing.

It is also possible to reduce fine scratches by laying the work with wire. A series of holes should be drilled along either side of the crack and at least 6 in apart from it. Use a strong flexible wire and no wire wire. This will not remove surface scratches, but will make the surface easier until better repair facilities are available or until a replacement can be made.

A more permanent repair can be effected by polishing with a wedge shaped piece with rounded corners.

The final step in repairing holes is to trim the hole and surrounding areas to

a circle as soon as possible. This will prevent the development of metal cracks around the hole and the metal around the slot will be protected. An emergency wing fabric or thin Plastiglas or cellulose acetate sheeting applied to the hole surface with "dope" as other solvent. Acetone, ethylene dichloride and lacquer thinner will serve to soften the varnish so that it is satisfactorily bond to the aluminum. This is not a temporary expedient, however, and must be replaced by permanent means of closing the plastic surface.

If more time is available, it may be possible to cut out and insert a Plastiglas or even wooden plug which will serve as a permanent patch or can be cemented in place, as described below.

Patching

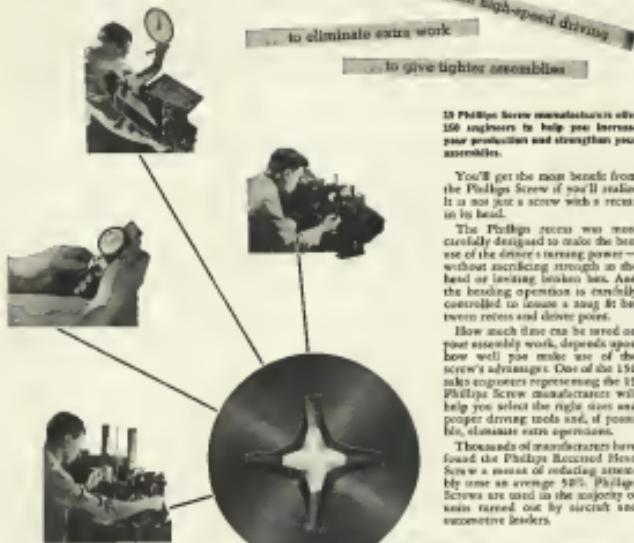
The three guiding principles of patching are: (1) Use patch and fit perfectly; (2) a firm pressure must be applied evenly to all edges of the patch while the repair is drying out; (3) sufficient time must be allowed for the varnish to dry.

The hole is trimmed on a perfect circle or oval and the edges of the hole given a slight taper. The patch is cut out of material slightly thicker than the section to be repaired and given a slight taper to fit the hole. The patch is then placed in the hole and held in an even or over on sanded heavy metal if it is very soft red phallic. Then it is forced into the hole and allowed to cool.

The patch is then removed and both surfaces washed with masking paper. The edges of the patch are cleaned to remove any remaining varnish or material which may be clinging to the edges and are completely softened. This may require 30-45 sec. for lacquer or 3 to 5 min. for cellulose acetate. The patch is then inserted in the hole again because the edges are tapered, pressure need be applied only on one surface and equal pressure will automatically apply.

(To be continued)

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IN THE HIGH-ALTITUDE FLYING that is essential of military aircrafts today, the bearing life is often governed by the fact that the bearing runs in the hot bearings on motor, compressor and air control systems, so such that it does not freeze at low temperatures and thus render the entire system inoperative. Before this fact was realized, thousands of bearings had been packed with heavy greases. To be sure, therefore, these bearings had to be degreased and repacked with a lighter substance. Like many other manufacturers, Fleetwings developed its own grease, which, in our knowledge, gives faster results than any other available device. Following is an explanation of its operation:

First, the bearings are degreased by dipping them in a naptha solvent and spinning by centrifugal force from an air motor. They are then dipped and spun again so that any remaining grease will be removed.

The next step, that of repacking, is accomplished by using the method that we have developed, and which is shown in FIG. 1. The simplicity of this device is apparent. It consists simply of a single layer, single plunger, and a nose-shaped nozzle, around which is a collar, or ring, which consists of rubber, steel, and leather sections. Grease is pumped from a concentrated Aladdin gun.

You'll get the most benefit from the Phillips Screw if you'll realize it is easier to turn a screw with a recess in its head.

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How much time can be saved on fast assembly work, depends upon how well one makes use of the screw's advantages. One of the 150 applications shown in FIG. 2, by the Phillips Screw manufacturer will help you select the right sizes and proper driving tools and, if possible, eliminate extra operations.

Thousands of manufacturers have found the Phillips Recessed Head Screw a means of reducing assembly time an average 50%. Phillips Screws are used in the majority of items turned out by aircraft and automotive leaders.

Production Boosters At Fleetwings

The January issue of AVIATION included an article titled Fleetwings Steps Up Production, which described a number of small, ingenious tools invented by Fleetwings' specialists. Since that time Fleetwings has developed other devices to speed output of aircraft parts. This article gives details on two of the most important of these.

By PERRY ANDERSON, Fleetwings Inc.

FIG. 2 shows a sketch of the device. The bearing is placed in the machine and the lower sleeve is moved up to the bearing position with the top center forming the bearing against the lower sleeve until the bearing is engaged by the lower sleeve. The bearing is thus perfectly positioned and sealed, ready for a shot from the grease gun. The variable length plunger is so adjusted that the two centers insure the bearing firmly at the time that the toggle bar is moved the left position.

The path taken by the grease is indicated by dotted lines in the base.

FIG. 3 shows the setting tool used for three-hole bearings. The lower sleeve is the lower sleeve at the point marked "A" and this extends directly to the opening at one end of the bearing, "B". Here the charge directs and permits of the grease to go through opposite halves of the bearing, with the excess going out through the shooting opening, marked "C".

Actual operation of the machine is as

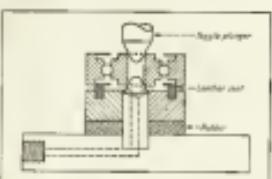


Fig. 3—Bearing shot base bearing is positioned by grease gun

Fig. 4—Fleetwings' device for repacking bearings.



PHILIP ANDERSON

plenty, it is of interestable and no use. As much as I do we have made up a number of them. For the many manufacturers who are trying upon the world method of making inspection holes, we would like to assure you, reader, that described, is a good thought, they will help to implement the production of aircraft.

Builders Cooperate On Flight Tests

Additional cooperation among aircraft manufacturers is required by Boeing in turning over to Consolidated comprehensive data on experimen-

tion and procedure of flight testing.

A seven man flight engineering group from Consolidated, headed by chief test pilot Ernest Steel, visited the Boeing plant in Seattle to familiarize the Boeing technicians test pilots with all phases of the Boeing system developed under the previous direction of Robert Allen.

The Boeing test team includes four

class A test groups—the pilots, all of

whom must have experience in flight

background, flight engineers, who give the

more complete data in flight and write

reports; equipment engineers, who pitch

parachutes of the planes, recording

data, and special test equipment,

and data analysts who compile and

present the results.

Another recent Fleetwing development is the small test clevis, a device for producing in-punch holes in sheet metal base for aluminum skin control surfaces. This machine does away previously tedious and repetitive soldering in which Fleetwing is manufacturing sound deliveries of airplane parts for assembly on many of the leading flying and building planes.

It is obviously not desirable to punch the holes in the skin in the flat metal sheet before forming, for once the skin is bent, it would never again fit into the forming punches. So it is possible to punch these holes in the formed skin box by using a conventional mechanical punch press. The method used, until a few months ago, called for hand cutting the holes after the skin was formed. This was slow and tedious for the metal skin sections involved. Furthermore, the manual cutting tended to produce edges which required filing. Much time lost! And even after filing there was a lack of uniformity among the holes, this being inherent in the manual method.

One solution to the problem is a set-screw wheel which we have designed from a pneumatic magazine riveter. Fig. 4 shows the operation. The nose bar is placed in position as shown, and the two dies, male and female, put in place. When the operator depresses the hole at maximum production of this size is increased more than 300 percent. The dies shown here are of oval shape, but we have also made square and square plates, depending naturally upon the type of hole needed.

While this number is of extreme im-



Fig. 4—Device for punching inspection holes in sheet metal parts

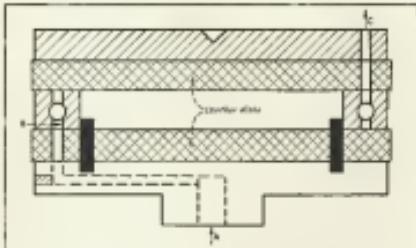


Fig. 5—Setup used for expanding deep-hole bearings



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RAF SPITFIRE FIGHTER



BRITISH HAWKER HURRICANE



NORTH AMERICAN MUSTANG, U.S. & R.A.F. FIGHTER



LOCKHEED P-38 LIGHTNING FIGHTER



CURTISS SB2C HELLDIVER



CONSOLIDATED PBY CATALINA



BREWSTER BUFFALO FIGHTER



REPUBLIC P-47 THUNDERBOLT



CURTISS P-40 WARRIOR



MARTIN B-26 MARAUDER



CURTISS C-46 CARGO TRANSPORT



CONSOLIDATED B-17 FLYING FORTRESS



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ELECTRIC PROPELLERS



To Those Who Fight

■ America's pledge to those who fight is a pledge of ever-increasing protection. A swiftly rising tide of weapons, of aircraft, ships, guns, tanks and accessories, is essential to the successful prosecution of the war. Breeze, with all its plants now devoted to production for defense, is meeting the demands of the U. S. Army, Navy and Air Forces.

is handing out its quality high quality Breeze products for service on land, on the sea and in the air. Breeze Shielding, Electrical Connectors, Flexible Conduit and Fittings, Aircraft Armor Plates, and Cartridge Engine Starters as well as the many other items of Breeze equipment, are to day giving dependable service on all fronts to those who fight for Democracy.

Breeze

NEWARK CORPORATION INC., NEW JERSEY

Radio Stations and Auxiliary
Equipment: Bremen Coast Guard Station; Bremen
Radio Control; Bremen Radio and
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Quartermaster Supply: Bremen
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Units; Nurses in Hospitals; First
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Exterminators: Pest Pk. and
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Electronics and Radio: Micro-
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Electrical: Bremen Power
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Systems; Bremen Control
of Physical Plant; Machine and
Automobile Problems.

Forged Cylinder Head Developed by Wright

New technique speeds production,
increases power output, saves weight.

THE FORGED CYLINDER HEAD, above with the nosecone removed for machining it, recently made possible to the entire aircraft engine industry by Wright Aeronautical Corp., after five years of intensive research and development, constitutes a tremendous advancement in the design and construction of stressed internal combustion engines.

Myron L. Gordon, vice-president and general manager of Wright Aeronautical Corp., says the new head will take 20 to 30 percent increase in the power output of an engine without any increase in weight. He also pointed out that the new technique would speed up production of heads, estimating a 40 percent saving in material requirements under the new method.

The strength of the new heads, achieved through fine and uniform grain

structure in the metal, permits much higher compression ratios and ready the increased power output per cylinder with not increased weight. In tests, the forged heads have shown 10 percent greater durability than the maximum for cast cylinder heads now in general use.

In fabricating the forging, aluminum

bar stock is extruded in a die to

the final shape. Then separate deep drawing operations are eliminated by adaptation of the extrusion process to the forged head. This results in a more uniformly dense deep homogeneous fiber for other uses in the war production program.

The casting fins, automatically cast as an integral part of the head, are forged heads are cut by high-speed rolling machines which prevent close freezing

(Turn to page 253)



The forging of the head is made from a section of an extruded bar passed to heat shape by dies. Casting of the finished head at left is required by other firms and a 20 percent increase in the weight of the metal.



LOWER LEFT: This is one of the newest military machines designed at extrusions with specifications supplied by Wright engineers, enabling the first aluminum forged cylinder head developed by Wright Aeronautical Corp. LOWER RIGHT: Front view of the cylinder head. The strength of cast heads weighs less and has weaker fibers. Those currently designed military cylinders of specify approaching those used in manufacturing. RIGHT: This is one of the first experimental military machines used in the new process, designed for cutting fins around the exhaust port. The new technique permits the improvement and improvement of intake and exhaust ports, resulting in increased performance.



Perspective Drawings Speed Plane Assembly

Three-dimensional drawings are now being used extensively to simplify and speed up assembly line operations. These so-called production illustrations also partially answer the skilled labor shortage problem by quickly introducing the new worker to his job on the assembly line.



KEN SHOTZ, former airplane hobbyist, after but three months on the job, used by production illustrations, is an efficient assembler at the Douglas Aircraft Company. He has no training other than that given by engineers while working from blueprints similar to that shown here.

WILLIAM C. ROVANLY checks a production illustration of a center section landing gear assembly as LaPensee P. Lemoine and Vernon D. Many work a bolted-on the last at the Pepe plant.



PRODUCTION ILLUSTRATIONS may well soon suffer the leveling of vital production tools in the aircraft industry. Their use of features is familiar to all who have seen auto and aircraft manuals pertaining to all sorts of mechanical products, but their application to aircraft line operations is new and rapidly increasing.

Simply defined, production diagrams are an entirely perspective drawing of an assembly section applied to tell the worker in visualizing the job he is working on. While the views of the function is peers to normal practice, the drawings serve also as instructional drawings for the assembly workers. They contain a great number of parts and tools needed for completing the assembly and already indicate the sequence of operations to be followed. To further add to their usefulness, even the job set up is included in the illustrations.

Production illustrations serve to replace blueprints for those who see them, and take the place of blueprints for the supervisor. What is gained here is that the supervisor need only see a simplified and understandable picture of the job before him, enabling him to do the work with greater speed and efficiency.

Discussion Unnecessary

One of the further differences between the production illustrations and the usual engineering drawing is the former's total lack of written directions. There is no need for all the descriptive detail on the assembly line because the part is already formed. It relies on the supervisor to the worker whether or not the part is in or is to be built, as long as it is readily identifiable by code or general shape to correspond with the drawing. All the worker needs to know is where and how it should be attached, and what tools to use in doing so.

For the supervisor, blueprints of the trial and preflight installations are

presently baffling. To search through dozens of unnumbered drawings to find installation data is a tedious and time consuming task. Oftentimes drawings with but the essential assembly data shown present an ideal working tool in these instances. Furthermore, there just aren't enough people experienced in blueprint reading to meet the requirements of the vastly expanding aircraft industry. The ability to train new men in the previous to a supervisor is a reliable method that can be used instead.

Tools Show Time Saved

Because of the multitude of fixtures involved, it is impossible to estimate the total time saved as a result of application of these production diagrams.

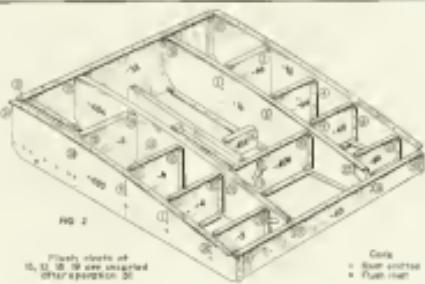
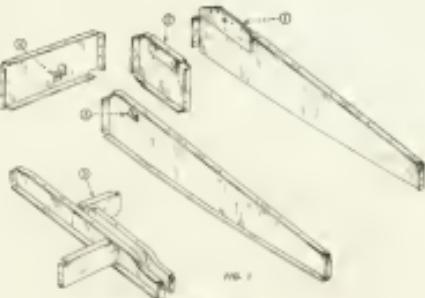
However, at an assembly plant, the Vans division of Lockheed can save one-third the time in the early stages of plane adoption on the Vans assembly line. The first sketches were drawn free hand as sometime reproduced on a slide projector and distributed in the shop. Two years, one with a production illustration, and one without, were assigned to an assembly line left and right hand wing spar assembly. The man working with the sketch completed the job in 12 hr. The man with the production illustration did the first run in 6 hr. The inspection department, on a test, used about the same proportion of time. The time difference is greatly magnified on fractional installations such as stabilizer or rudder.

In effect at Douglas, the claimed time taken by an experienced man for a given job was 6.10 hr. A new man with a production illustration was able to do the job in 2.9 hr with the aid of a production illustration. With further experience, and a sketch available, the new man would reduce the time of assembly considerably further.

To demonstrate the use of production illustrations in practice, the accompanying sketches show the assembly of the front landing gear of a Douglas aircraft model of shorts design. Fig. 1 of the series shows the assembly of four structural members of the door. Each arrow denotes one of the operations and in actual practice the drawing includes the number and name of each part involved in each of the operations.

Fig. 2 shows the assembly of the front landing gear door. The numbers per Fig. 1 are coded numbers indicating the proper sequence of the riveting operation. This sequence is also listed in the instructions normally appearing on the sketch along with the list of parts.

Two additional assembly operations are shown in Fig. 3, indicate the methods the riveting operation. In these production illustrations, certain parts are pulled out of position where necessary for clarity.



Finally, sketch of
15, 16, 17, 18 are
assembled after operation 20



Weight Engineers Meet in Chicago

SAWE meeting draws record attendance with well-attended program

THE SOCIETY of Aerospace Weight Engineers, Inc., held their second national conference April 22-26, at the Palmer House, Chicago, IL.

The three day session was professionally moderated by SAWE members, officers and guests. The scope of the values of work accomplished and the number of problems solved through mutual agreement.

The total attendance of 33 men included representatives of 25 aircraft manufacturers, 8 defense, 6 aerospace manufacturers, 1 engine manufacturer,

the Air Force, Civil Aviation Administration, 8 scale manufacturers, and various Magazines.

The first day of the meeting was devoted to military projects, the second half-day to civil industry projects, and the last two days given to general industrial projects. The following projects were presented and discussed during the meeting:

- Aviation weight statement
- Volume II—Aerospace Weight Handbook
- Seal of Weight Approval
- Propeller Weight and C-G Data
- Accuracy Weight Data

Sixty of the more significant projects which were brought to a successful conclusion at this meeting will be brought up to date and discussed in full in future meetings.

The society was organized on a local basis in 1959 in Los Angeles, but in partly never is a national organization with chapters throughout the country. It is founded on the belief that a continuous contribution can be made to the future development of aircraft by the application of research to weight control and to manufacturing procedures.

At this meeting each division essay panel served up a weight of an aircraft structure minus additional range and the ability to carry heavier loads of armament and armament. The SAWE is performing a vital function in facilitating the interchange of ideas and information in this rapidly progressing science.

The SAWE national offices are 1942 W. 11th Street, Suite 200, Los Angeles, CA 90045. The current president is Robert H. Brown, Lockheed Avionics Corp.; treasurer, G. Fred Cookstock, Rockwell Aircraft Division. In addition, the society's organization includes five regional divisions, each of which has its own chairman and officers.

At the recent meeting, the society decided to hold its next national meeting in Dallas, Tex., next year.

Thread Standards Adopted

The American Standards Association has issued standards covering general purpose Acme threads, with an angle of 30 deg between sides of the thread, one 30 deg lead thread, the 30 deg dielectric, and a modified square thread with a 30 deg angle between sides of the thread.

Because of widespread application of these threads in industry and the importance of standardization to wire gilding the British Standards Institution is considering making similar adoption.



NAVY "E" TO BREMNER AIRCRAFT
The Navy "E" traditional symbol of excellence in the performance of duty, was awarded the Bremner Aerospace Engineering Company for its outstanding achievement in building the "Widjet" fighter and "Amerig" transport/bomber. Participating in the presentation ceremony were James F. Pascual, Safety Director of the Navy; Andrew L. Stiles, Associate Director of the Navy for All and Space; Admiral John H. Tamm, Chief of the Bureau of Aeronautics, who made the speech of presentation; L. A. Bittel, manager vice-president and plant manager [right of Navy officer or pilot]; and Russell T. Belknap, chairman of the Bremner employees organization [hidden in shadows] except the award.



Save ASSEMBLY TIME!

We can save you valuable time in assembling "American" flexible low-tension shielded conduit and fittings

This is an opportunity to save considerable time in the assembling of fittings and low-tension flexible shielding conduit.

The same firm who produce both the conduit and fittings . . . the people who know the product inside-out . . . will perform this assembly job for you—in your exact specifications.

Simply send us the complete specification. We'll do it by mail how we can handle your assembly to your best advantage.

American Metal Hose makes a complete line of fittings and accessories for American Flexible Low-Tension Shielded Conduit. Both fittings and conduit conform to A.N.A-C and N.A.F. Specifications



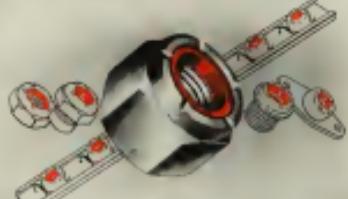
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AMERICAN METAL HOSE BRANCH OF THE AMERICAN LEAD COMPANY • GLENDALE OFFICES: WHITBURY, CALIF.
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The Douglas C-47 Flying Boxcar, a common freighter of aircraft aircraft and military aviation with Northrop Bomber



WHEN THE BIG TEST COMES



these nuts hold tight

Bolted connections on military airplanes call for lock nuts that hold with a grip which is positive and yet sufficient so that, before the extreme vibrations, the stresses, and the shocks of high-speed maneuvering . . . a grip that protects the ships and the men who fly in them.

Evidence that Elastic Stop Nuts meet all-important requirements is found in the fact that they are used for vital structural and equipment fastenings on every military airplane built in the Western Hemisphere.

There are more Elastic Stop Nuts on American airplanes, boats, and other war equipment, than all other lock nuts combined. THE RED LOCKING COLLAR . . . SYMBOL OF SECURITY. ELASTIC STOP NUT CORPORATION - 2300 VINEHILL ROAD - UNION, N.J.



A Catalog will be sent on request
Lock nuts and nuts for bolting are readily available.

Review of Patents

Airplane modification. No. 2,377,172. Inventor: James E. Johnson, of Los Angeles, Calif. Assignee: Lockheed Aircraft Corporation. A means for reducing the weight of an airplane, which includes a portion of the fuselage in which structures are over the interior and underneath, which increases the weight of the aircraft.

Process for operating aircraft, particularly flying boats, having airways. C. H. R. Webb, of Waukegan, Ill. A flying boat method involving the use of compressed air to operate the main control surfaces, the compressed air being supplied by the ship's own compressor.

Airplane. No. 2,377,182. Inventor: A. E. Karrasch, assignee to Douglas Aircraft Co., Inc., Santa Monica, Calif. The invention provides a means for increasing the load capacity of the pilot's seat in addition to the pilot's seat mounting. This increases the maneuverability of the aircraft in the event of an emergency landing.

Pivoted and rotating means therby, No. 2,377,183. Inventor: C. J. L. Smith, assignee to Kaiser Aluminum & Chemical Corp. A pivoted and rotating apparatus for locking purposes which prevents the rotation of a part about an axis of rotation in the locality of a pivot point.

Aircraft construction. No. 2,377,184. Inventor: G. W. O'Neale, assignee to Glenn L. Martin Company, Md. A longitudinal bulkhead for an aircraft which is constructed to be attachable to ship's bulkheads only at points where a transverse bulkhead is located, so that the longitudinal bulkhead need only connect effectively to several transverse bulkheads, thereby reducing the number of rivets required by half.

Airplane seat. No. 2,377,185. E. M. Hartman, assignee to Boeing Airplane Company, Seattle, Wash. An airplane seat having a locking mechanism holding and supporting. Which uses a safety belt hook having a safety belt which is attached to the seat and which is retained by the locking mechanism of the hydraulic arm.

Airplane landing gear. No. 2,377,186. R. C. McRae, assignee to Boeing Airplane Company, Seattle, Wash. A landing mechanism for an airplane, particularly one which is an airframe which has a main wheel which is pivotally mounted and which is pivotally mounted out of the way of the wheel. The starting position of the main wheel is automatically locked when the aircraft is in motion.

Locking device. No. 2,377,187. D. C. Lewis, assignee to Wright Aeronautical Corp., Paterson, N. J. A locking mechanism for the retarding of the rotation of an aircraft propeller, which permits the propeller to be stopped without the need of increased counter-clockwise rotation and counter-clockwise rotation and otherwise decelerating.

Fastening process. No. 2,377,188. E. Morris, et al., assignees to Westinghouse Electric Corp., Baltimore, Md. A fastening technique for joining two parts together by heating the base of which is impregnated in one area, and the second part is heated in another direction by heat-treating means. The second connected to the first direction by heat-treating.

Orbital mechanism that allows repetitive orbital motion. No. 2,377,189. J. F. P. Nichols, assignee to Aerostar Co. of America, White Plains, N.Y. A spinlock mechanism for the purpose of effecting a continuous, nonstop, orbital motion of a body around the center of the earth or another celestial body. The orbital motion may be in either direction, clockwise or counter-clockwise, and contains the use of a single motor.

Military airplane. No. 2,377,190. V. J. Borrelli, assignee to Douglas Aircraft Company, Inc., Long Beach, Calif. A military airplane which has a wing which is designed to reduce the average height of the fuselage in the wing area and, in the event of a strike of the wing leading edge, the new high speed strike causing

Welding Gas Conservation Imperative

Demanded for oxygen and acetylene for welding has pyramidized so rapidly in war production factories that, despite additions and expansions of plants making the gases, it is reported a critical situation. Since the industry relies upon welded conservation measures are adopted.

Illustrative of efforts already being made are those of Air Reduction Sales Co., whose salesmen have for some time

been urging the operating departments of steel mills to adopt welding processes which reduce the use of oxygen and acetylene. The following is representative of the many efforts according to sources:

Pivoted and rotating means therby, No. 2,377,183. Inventor: C. J. L. Smith, assignee to Kaiser Aluminum & Chemical Corp. A pivoted and rotating apparatus for locking purposes which prevents the rotation of a part about an axis of rotation in the locality of a pivot point.

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edge, the new high speed strike causing

explosives must be abandoned, for it "breathes" steam at a time when rapid temperature changes are most dangerous, by providing frequent admissions. You can help by sealing your cylinders closer, and by keeping reserves of cylinders at a minimum.

5. Oxygen cylinder pressure.

6. Don't leave oxygen burning tubes on fire. It may seem irksome to be constantly extinguishing the torch, but if it leaves the fire even as little as 10 min. each hour, it is worth the trouble.

7. The percent of last year's industrial oxygen consumption was 200 tons less on May 1st. Let's use the same 1,000-ton tanks for welding and cutting, not for heating the air.

8. Keep your clean and free from carbon and slag dust cleaned up as you sufficient trip. Carbonic cylinders multiply the value of using proper processes and speeds, resulting in lower oxygen and consumption costs of gas.

9. Don't use oxygen cylinders. A damaged cylinder may be broken off or cracked. It's conceivable nothing while undergoing repair.

10. Avoid static with care. Because less heat is needed to start a flame, it is more likely to occur.

To prevent this, it must be protected against insulation which promotes static. Therefore, keep heat off of tank ends and spurs, wash off all oil and grease, which may accumulate on the exterior of the tank, where static can cause damage, when any heat source is applied to the tank, and, when a heat source is applied to the tank, cover the heat source and apply the tank together with insulated welding supplies.

11. Use tools of rubber and metal as conservers. Keep bare skin of sparks and slag over mouth when using oxyacetylene torches.

12. Clear cylinder valves when they are in use. If only the tank valves are checked, oxygen pressure in the line may drop.

13. Check hoses and accessories for leaks. They may be held but a 1/4 in. diameter leak in hose operating at 100 lb. will waste 200 cu. ft. of oxygen per day.

14. Check hoses and accessories periodically by listening to a water while under pressure, to show any leakage. Snap end under will reveal holes in hose.

15. For normal diameter Anne Glass tank, it is too small requires higher gas pressure to secure sufficient flow, causing unnecessary strain and promoting leakage.

16. Check hoses lengths of Anne Glass tanks.

17. The simple length of the hose which serves the job, are subjected to no unnecessary wear and tear.

18. Use all the gas in each cylinder by first connecting a new one to the cylinder which is being used. Large tanks are subject to interruptions of work to change tanks by handling gas cylinders, or by installing pipe lines.

19. Use cylinder stockroom low. The best reason of keeping plenty of reserve



tips out during welding, preventing additional oxygen.

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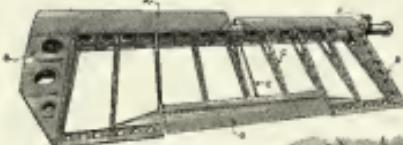
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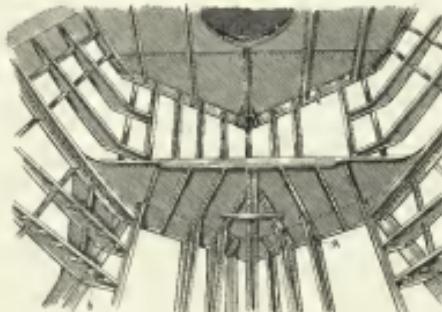
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Wright Aeronautical Corp. employs matched lead-wire cathodes with always matched with P of core wire for combustion. This keeps same type of tungsten electrode required from other as part of preheat to speed and increase settings open flame.



The aileron of the Consolidated P-32 has a Boeing leading edge. This is shown at 'W' in the sketch above. Attached to this dagger are reinforcing aluminum alloy plates 'M' at the root end, supported by two rivets which actuate rapidly in the aileron. These are covered by fabric. The aileron deflection from full 'D' is indicated by the control tube 'E' and the aileron elevator is moved by the lever 'F'.



Part of the wing structure of the Boeing Model 247 is shown above. Basically a biplane structure, the spar flanges are of extruded aluminum with the top and bottom flanges strengthened by a horizontal rib. The main longitudinal members are of extruded aluminum 70-7200, which is lighter than that of the Model 247 fuselage, with the difference the extrusion having a flat at the outer surface from one end of the spars themselves. In the flying ducts the Americans were in the form of twisted flexible members. An additional structure is the rear attachment. The heavy loads carried in the Boeing's wings, the break loads for which are shown at 'A'. These are those of these loads, calculated near the wing root, in either wing.



Grumman **Uses VICKERS**

HYDROMOTIVE CONTROLS

Vickers Hydromotive Equipment is used on many of the most modern airplanes. The Grumman Carrier Fighter illustrated here is representative.

Vickers Hydromotive Controls are high pressure oil hydraulic controls that are so widely used because they do the job dependably, smoothly and accurately . . . no matter how severe the service.

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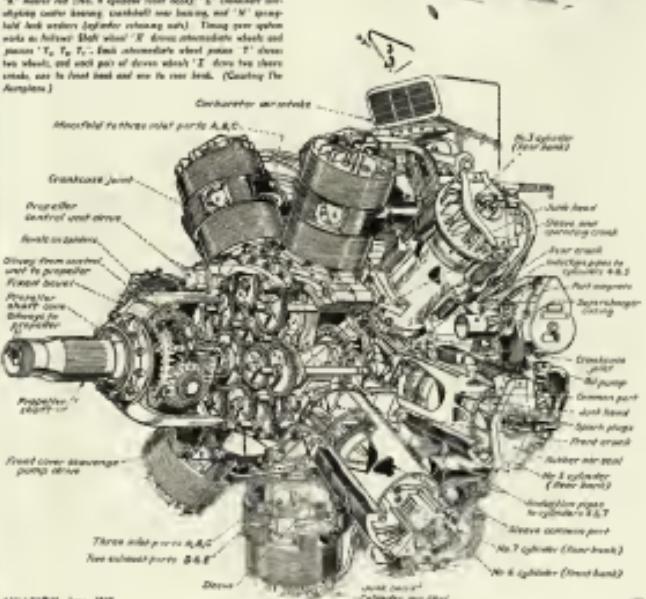
**LIGHT, DETACHABLE
FITTINGS FOR BETTER
PERFORMANCE, SERVICE
AND MAINTENANCE - -**

AERO-QUIP CORPORATION
JACKSON, MICHIGAN, U. S. A.

AEROQUIP SELF-SEALING COUPLINGS



The company's annual sales figure in the Minneapolis-St. Paul area is of modest size but consists of three main parts—*retail*, *wholesale* and *mail-order*. The retail business is based on the local and surrounding areas, the wholesale part is based on the upper Midwest, and the mail-order part is based on the West Coast. The retail business is based on the local and surrounding areas, the wholesale part is based on the upper Midwest, and the mail-order part is based on the West Coast.



The *Hopitalier*, Jean Batriot's Marins rated engine, rated at 1000 b.h.p., is used on the *Sainte Hélène* heavy broadside, and as shown in the cutaway view above, the Marins rating is not far from the torque production, which is listed below in 1000 ft-lbs and closely before the *Pocessus* in its present form. The two pairs are shown at "A" and "B", while vertical pairs are set at "C" and "D". The gears should be in one gear with the propeller; there should be "P" and "P" in the ratio beaming (redirection) when driving ahead; "H" has been omitted from the diagram, as it is not used in the *Hopitalier*. The *Hopitalier* and *Le Caporal* had both "E" cross-shafts anti-rotating contra-beaming, (cross-shaft one bearing, and "M" propeller shaft with another longitudinal counter-shaft). Thus gear system works as follows: "F" *Hopitalier* "M" drives astern-shaft wheel and planet "T₁ T₂ T₃ T₄" from intermediate wheel "P"; "T₁" drives two wheels, and each pair of wheels drives wheel "E"; "E" drives bow three struts, one to *C* front broad and one to *C* rear broad. (Courtesy *Armements*.)

THE Standard OF THE INDUSTRY

Designed, built and tested for aircraft use, Wittek Type F8 Stainless Steel Hose Clamps are used by leading aircraft manufacturers, engine builders and commercial airlines as the standard Hose Clamp of the industry.

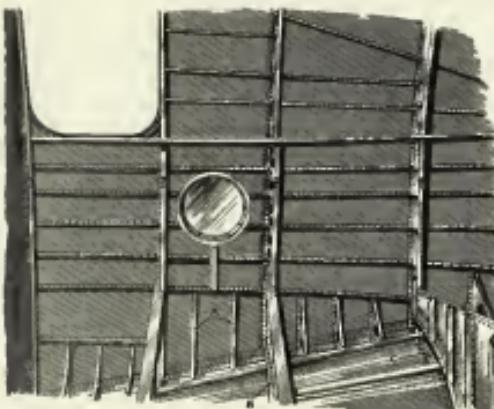
TYPE F8, STAINLESS STEEL

WITTEK
Aviation
HOSE CLAMPS

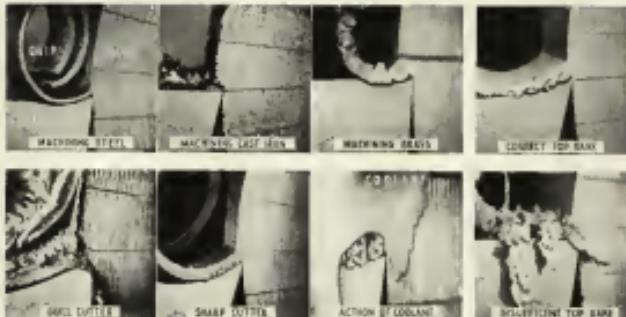
WITTEK MANUFACTURING CO. 4305-15 W. 24th Place, Chicago, Ill., U.S.A.



This interior view shows, of the Boeing Flying Fortress construction, is of the section just off the leading edge of the wing. The pressurized aircraft gas system is installed in "A" and the steps in the foreground lead the other end of the bomb bay underneath which measures 42 D. T. or in length. At this end of the bomb bay the steps for the paratroops boys are installed.



The port side of the new interplane of the Pima-Bidwell YB-44 A is shown at right. Notice the position of "A" which is required to hold the side and bottom of the hull to make the construction of low wheel access at the corner. Notice, also, how the dimensions of "B" are below the bottom deck and the notes say while at "C" the bottom is brought out flush with the skin.



These motion photo-ops show the operation of metalworking cutters from the leading cutting-edge Chaco, a feature of Warner & Swasey Company's new training program on the grinding and cutting of cutting tools.

Film on Tool Grinding and Cutting

A most instructive sound movie and talk on the proper method of grinding cutting tools and the effect when grinding and tool setting have on the cutting of which have been announced recently by Warner & Swasey Company, well known makers of turned bodies. It is planned that the film and talk will be given at plants engaged in war work before operations and transfers between shifts or at other hours convenient to all interested.

This is to be done by appointment with the company's Travel-Lite Operators Service Bureau and without charge. Models of tools and charts are used in combination with the talk and opportunities for questions are afforded.

Operators who attend the program

receive a 16-page illustrated booklet containing the basic principles of instruction and showing what happens when tools are properly ground and when grinding is not properly done or is delayed too long.

Normally the program requires about one hour. Although designed specifically with the types of tools used on metal lathes, the fundamentals shown and discussed apply equally well in other lathes and in some other tools used for metal cutting. The whole program is highly instructive and of a type which operators understand and appreciate.

Hydraulic Test Regulator

An apparatus capable of testing oil hydraulic parts in an airplane configuration has been put into production at the Goodyear Aircraft plant. The machine performs its task by simulating speed and flight conditions, and testes to failure equipment which had to be applied to one part at a time. As seen in the photo, it is a laboratory as well as with means to show the reaction of a plane under critical conditions.

The particular apparatus shown was built by Henry Beck, foreman of the Plant 2 Hydraulics Department. During a recent Government inspection, A. L. Parker, accomplishments of the machine is its ability to prove the whole hydraulic system and interlock with all valves in a few minutes. The task formerly had to be done by dismantling the oil lines the hydraulic system.



For the apprehension of hydraulic men, Dick Bechtel, Inc. of Brooklyn, N. Y., manufacturer of special tools, tools and accessories to the war effort, has just issued the above chart of decimal equivalents. The chart is based on the values of the metric system of measurement. The chart is also available in metric values.

AVIATION, June, 1942



The B.F. Goodrich Airplane of the month

CURTISS WAR HAWK

FROM THE ROAD TO MANADALAT to the frigid deserts of Russia, the Curtiss P-40 type fighter has earned a record performance for the United Nations. And it is only natural that this bullet-swift pursuit bears the Curtiss name. For, since the days of the "pusher," Curtiss-Wright has been a leader in aviation.

Other members of the Curtiss family now winning their service stripes for Democracy include the Navy's "Hell Diver" dive bomber and the large C-46 transport. B. F. Goodrich advises Curtiss and manufactures the War Hawk, newest Curtiss pursuit, as "Plane of the Month."

The Army flies with
Goodrich
FIRST IN RUBBER

B.F. GOODRICH RUBBER RESEARCH FOR THE

Airation industry



AMERIPOL

...our synthetic rubber that is serving America now!

UNCLE SAM'S challenge is to "Keep 'em Flying." And that means dozens of rubber or synthetic rubber parts must be available. B. F. Goodrich is pleased to report on the contribution our own Isocellene synthetic rubber, known as Ameripol, has already made, to help the industry meet that challenge.

For many products, Ameripol has proved far superior to natural rubber for aeronautical purposes. Ameripol's resistance to gasoline and oil, for example, has made it ideal for airplane hoses, hydraulic seals, and other accessories where natural rubber tends to cut and disintegrate.

The following chart, which illustrates the relative properties of Ameripol and natural rubber, immediately makes plain the advantages of switching to Ameripol. It is aviation synthetic, for many items:

Properties	Synthetic Isocellene	Natural Rubber	Properties	Synthetic Isocellene	Natural Rubber
Resistivity to Alcohol	+	+	Tensile Strength	+	+
Acids and Alkalies	++	+	Flexibility	++	++
Oils	++	+	Permeability	++	++
Water	++	+	Temperature Resis-	++	++
Oil, Gasoline, Benzene	++	+	tance	++	++
Glues	++	+	Hygroscopicity	++	++
Petroleum	++	+	Electrical Insulation	++	++
Code	•	•	Heat Resistance	++	++
Color	•	•	UV Resistance	++	++

Ameripol, a product of 16 years' research in B. F. Goodrich laboratories, was first announced publicly in June, 1940, as a general rubber for aircraft, notably in tires. On the right-hand page are some of the products made with Ameripol that are now in use. We are proud of this contribution and we pledge our continued efforts to "Keep 'em Flying" with natural and synthetic rubber parts.

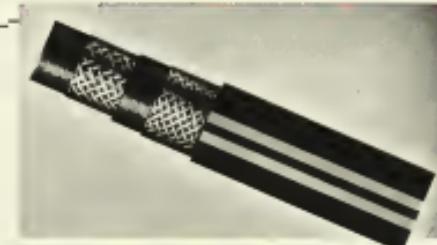
Write for descriptive literature. B. F. Goodrich, General Offices, Akron, O.



MAKERS OF B. F. GOODRICH TIRES AND OVER 50 RUBBER
AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES

Ameripol

SERVES WITH THE AIR FORCE



GASOLINE AND

OIL HOSE.

Airplane hose serves in a number of important products on United States fighting planes. Proven by performance, Ameripol synthetic rubber was used for B. F. Goodrich fuel and oil hose many months before the war emergency brought synthetics to their present prominence.



GROMMETS + HYDRAULIC

SEALS + GASKETS.

Perhaps they look trivial. But they're vital to a plane's performance. Made with Ameripol, they offer low oil absorption (which does not exceed 0.5%)—high resistance to heat, heat and cold temperature—will not cause insulation to be adversely affected by desired pressure increases.



THE EXPANDER TUBE

of a B. F. Goodrich E. T. Brake is also made of Ameripol. When this tube is inflated with braking fluid, it expands, forcing the brake lining blocks into uniform contact with the revolving brake drum mounted in the plane wheels, and the plane comes to a smooth, safe stop.





MOLYBDENUM ENLISTS FOR THE DURATION

The enormous increase in requirements of molybdenum has necessitated the War Production Board Order M-10, placing molybdenum consumption under allocation control....Our metallurgical research staff is fully engaged in war work. At our mine, mill and converting plant, every effort is being made towards maximum production.

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MOLYBDIC OXIDE—BRIGGETTE OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
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various types of wheels that may be required to produce the work. Wheel mounting is universally bearing, the large shaft bearings and bearing, self-aligning ball bearings and driven by a triple V-belt drive. The dial plate provides quick adjustment for wheels requiring a diameter from 18 to 38 in. A suitable running curve is provided for truing the wheel while in motion. The wheel may also be advanced to and from the work while running, pressuring flat, accurate adjustments. Centering feed is mounted on a tilting housing which provides for varying the speed feed as desired. Maximum feed is 10 in. per min., height of center above floor, 30 in., wheel spindle, 12 in. dia. range, 6 in., wheel, 20 in. dia. by 4 in. face. Horsepower required 72 to 30, furnished either belt driven or direct motor connected — AVIATION, June, 1942.

Duro Punch Press

Equipped with bearing supports at all four points to assure long life at top production speeds, a new line of punch presses is now being offered by the **Bass Mfg. Co.**, 880 E. 42nd St., Los Angeles, Calif. Available in one-ton and four-ton models, the Duro Punch Presses have many features not found in any but the heaviest presses. Said to be an exclusive feature, is the lead



treated alloy steel driving shaft which is absolutely vibration-free and noiseless, without eccentric, eliminating danger of starting or tearing. Differential change of punch force is transmitted by a unique connecting plate fit onto the driving shaft and held securely by keys. Harmonic operation is insure by bearing supports. The rate of punch of the Duro presses, rates at arm-and-gauge, stated for balanced distribution and adjustable for wear. Specifications:



14-ton—weight, 185 lb., width, 22 in., height, 25 in., depth, 15 in., accommodates dies up to 40 in., stroke standard, 1 in. (3-ton)—weight, 80 lb., width, 8 in.; height, 17 in., depth, 10 in., accommodates dies up to 32 in., stroke standard, 1 in.—AVIATION, June, 1942.

Duplex Grinder

An abrasive hand and disk grinder, the Duplex B-M model, for which **White Metal Corp.**, 86 Winton St., New York, N.Y., are sole sales representatives, is available for use in aircraft and accessory plants. The



Duplex B-M Grinder is really a power driven Duplex B model. Machine is equipped with a 1 1/2 hp. heavy duty motor mounted underneath frame casting. A fully enclosed dual V-belt drive is used. The unit has a dial plate for adjustment for taking up slack in the V-belt as provided. The head grinding table is 18x24 in. and the disk grinding table 10x17 in. The shaper head is 8x8 in., while the disk is 12 in. in dia. Speed is 1,200 rpm.—AVIATION, June, 1942.

New Dial Feed Press

Recently in the accelerated program in the manufacture of the new Federal Malleable Dial Feed Press, by the Federal Press Co., Elkhart, Ind. Positive feeding and locking mechanism of the dial feed permits unusually high speed with accuracy and safety. All moving parts are enclosed, except the dial plate itself, reducing the possibility of injury to the operator.

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AVIATION CABLE



Crescent manufactures a complete line of electric wire and cable for every aircraft need—starter cable, high tension cable, primary cable, coil or no-ground cable. Crescent manufactures welding cable.

And every Crescent Aviation Cable is a quality cable, made of precision materials, manufactured under the Duplex Method of construction. For high efficiency, long life, dependability and uniformity.

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multi-braid constructions.

P.S.

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**HERE'S MORE Airpower ...
TO SPEED THEM ON THEIR WAY**

POWER—plenty of it—that's what it takes to carry on today's rigorous production schedules. And plenty of airpower is what you get when you install sturdy Gardner-Denver "HA" Two Stage Horizontal Air Compressors. Yet, there is no waste of power, for the greater air capacity of "HA" compressors is under constant, automatic control—and the air supply is constantly regulated to fit your air needs. Operating costs are low because these compressors are designed for unusually low horsepower requirements. Maintenance costs are minimal—as user experience in many a plant has shown.

For the complete specifications on Gardner-Denver "HA" Horizontal Two-Stage Air Compressors, write Gardner-Denver Company, Quincy, Illinois.

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AVIATION JUN 1962

"HA" ADVANTAGES

1. Long years of service assured by rugged, skid-free construction.
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3. "Air-cushioned" Duo-Plate Valves actually become lighter with use.
4. Built in sizes ranging from 356 to 2012 cu. ft. displacement per minute.



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Somewhere, tonight, the Navy has a task force in action. In thousands of places, on land, on sea, Industry has task forces in action too.

This one, operating at VARD, is engaged with America's greatest adversary—like the Navy forces, it is alert, determined—and moves with precision. It knows it is in a war.

Other task forces at VARD—in research and in production—are also working against time; also in the war.

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PACKAGE



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REZNOR MFG CO. 401 South St., Allentown, Penn.

"100 YEARS EXPERIENCE SINCE 1881"

Heim Disc Polisher

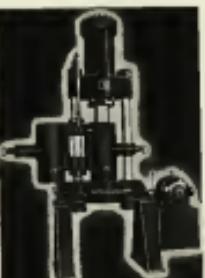
New in extensive use for production grinding of ball races on straight barrels, the Heim Disc Polishing Machine, made by The Heim Co., Fairfield, Conn., is completely motorized. This machine is said to be the present in the method of polishing drawing dies by the use of an



and operating. Two types of discs may be supplied. A straight one for straight cuts only, or a curved one for straight or single cuts up to 45 deg. There are three outstanding special features of this machine: the patented hand operated press, new non-fraying flexible, and ends of larger abrasive discs from larger Bader or other self-adjusters.—*AVIATION*, June, 1942

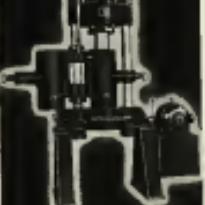
Watson-Stillman Press

A 500-ton-capacity hydraulic straightening press, manufactured by The Watson-Stillman Co., Berlin, N. J., straightens shafts under a pressure of 2,000 lb. per in. The machine has two cylindrical cylinders, each 16 in. in the end and 22 in. deep, mounted on a carriage arm so that they can be moved while the press throat is released from the cylinder. The press is completely self-contained, containing 30 lb. water, 18 open pumps, and oil tank. The entire unit stands 14 ft. high, weighs 35,000 lb., and requires 3 ft. x 3 ft. of floor space.—*AVIATION*, June, 1942

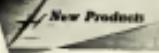


Radius Abrasive Machine

For accurately cutting off bars, tubing and formed shapes, A. P. de Saussa & Son, Philadelphia, Pa., offers the Radike Type S Abrasive Cut-Off Machine. The cut is clean and smooth, and certain requirements and additional features are provided. The machine cuts the work and work at the part of cutting, increases wheel life, reduces cutting heat, and maintains any tendency to burn. Steady concentration of every part of the machine, precision mechanisms and proper balancing of all moving parts are said to eliminate vibration which in the case of coarse-grained parts are said to eliminate wheel wear, and result in econom-



AVIATION, June, 1942



spine. Control is by a single, lever operated valve. The press has a 33 in. stroke and operates in a double-acting cylinder. Two constant lifting cylinders facilitate swinging of the machine between locking and operating positions.—*AVIATION*, June, 1942

Hammond "600" Driv-N-Wel

A new "600" Driv-N-Wel abrasive belt surface has just been placed on the market by Hammond Manufacturing Company, Inc., 5079 Douglas Ave., Kalamazoo, Mich. Machine can be adjusted from vertical to horizontal position while running. The belt tension and tracking device can likewise be adjusted while running, and is quickly accomplished by two conveniently located



knobs. Machine is totally enclosed for safety and the "600" Driv-N-Wel abrasive is designed for an individual dust collection for connection to a vacuum system. The abrasive belt pulleys are made of cast iron and are counterbalanced. Work table can be adjusted to any desired working angle and is available for bench or floor model. The Driv-N-Wel machine (floor model illustrated) is equipped with tank and pump unit and can also be equipped for water mist connection only if water should operate, and attach to exhaust connection at this point. There are two pulleys eliminating belt slippage, formulated on wet machine only.—*AVIATION*, June, 1942



ANNEALING AND HEAT TREATING EQUIPMENT FOR THE AVIATION INDUSTRY

Above is a special Annealing and Heat-Treating Bunker made to specifications for a large aircraft manufacturer. Enlarged plant facilities made possible the delivery of all types of Carburing and Annealing equipment promptly. We are prepared to handle your requirements now. Here you will find quality production on a quantity basis.

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AVIATION, June, 1942



The G-E Switchette

1 1/4 in. x 3 1/2 in. x 1 1/2 in.

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Available in single-circuit or two-circuit form

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2. G. E. G-6 vibration requirement
3. Suitable for use at altitudes from sea level to 40,000 ft
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SOME OF THE MANY AIRCRAFT APPLICATIONS OF THE NEW G-E SWITCHETTE



On Atmospheric-pressure Switches

In Bell Switches

Being Transferred Between Two Contacts

Send for FREE CATALOG on LINE SWITCHES, CONTACTORS, RELAYS, PRESSURE SWITCHES and SOLENOIDS

General Electric Company, Schenectady, N.Y.
Please send me your new catalog giving complete information about all the control devices that you now have available for aircraft electric systems.

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SHOP EQUIPMENT & ACCESSORIES

Oil Proof Aprons and Gloves

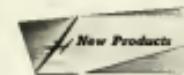
Developed especially to prevent contamination that causes greatest loss in many industries is a new line of oil-proof and solvent-proof gloves and aprons manufactured by Reinhardt Corp., Hellertown, Pa. The gloves and aprons are made of an extremely tough flexible material



with high resistance to tearing and abrasion, and the aprons are supplied both in a transparent type, and a heavy-duty type employing flexible fabric coated on both sides with a sturdy film of Reinhardt PTFE material. According to the manufacturer, they are suitable to all oil-resistant solvents, including aliphatic, aromatic and chlorinated hydrocarbons, and resist salt, hydrochloric, sulfuric and nitric acids. The aprons are recommended to be worn continuously in degreasing operations, where protection is needed against cutting, scratching, tri-chloroethylene, perchloroethylene, benzene, or gasoline solvents and in degreasing operations where they are unaffected by kerosene, varnish, etc. Because the gloves contain no supplies they do not permit heavily powdered metal residues and are recommended for applications of ball bearings, aircraft parts, etc.—*Aerospace, June, 1942*.

New Champion Generator

A new line of 20 volt, 55 ampere permanent magnet generators for aircraft has just been introduced by Champion Aviation Products Co., Los Angeles, Calif. This adds a horsepower rating to the former line of current and direct-current power generators. New generators meet all specifications of leading engine manufacturers, and are complete with



regulators mounted on separate units with a vent so that taking care can be taken in the normal point for air cooling. Standard BAR mounting or round plate mounting is available. Either left or right hand rotation will be accommodated. The 20 volt models weigh only 22 lb. 10 oz. or 9 lb. 10 oz. overall, with a dia. of 12 in. They are light in weight, with dual need when necessary possible. Given sealed ball bearings are used throughout and electric graphite brushes assure long life. Electrical parts are brass, aluminum



plated—assembled with flexible strip
Vacu-Arcure, June, 1942

Heisemann Circuit Breaker

A new, small current breaker for the protection of airplane lighting, motor, radio and control circuits has been developed by Heisemann Circuit Breaker Co., 180 Plaza St., Trenton, N.J., to meet the specifications of a number of aircraft manufacturers. The breaker, while retaining all the unusual features of the larger Heisemann "Aero-Magnetic" unit, has been reduced in size and weight by approximately 50 percent, measuring 20 in. long, 20 in. high and 800 in. wide and weighing but 10 lb. Maximum capacity of this breaker is 50 amperes, and it operates an arcointerupter assembly in 1/500 sec. Interrupting capacity is 5,000 amperes. Despite fully automatic operation, there is definite control action, the breaker being entirely independent of its time delay characteristics. The magnetic trip with time delay gives delayed trip in hem-



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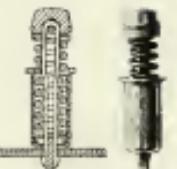
less continuity, such as passage of alternating current, but provides a high speed trip on short strength and dangerous overloads. After breaker opens it may be reclosed at any time provided current has returned to normal. Breaker cannot be held "closed" against any emer-



ing overload or short circuit. Due to absence of any heating elements, no current carrying capacity and maximum and instantaneous trip points are not affected by voltage and current changes in temperature. And being vibration proof and resistant to shock, constant protection is ensured under all flight conditions. All parts are easily disassembled to prevent corrosion, handle is ordinary toggle type and can be fastened with a business dot in the end and Japanese lettering of "U.S.A." and "E-Z" for high visibility—Aviation, June, 1942.

Scorill Skin Fasteners

A new aircraft skin fastener, made by Scovill Mfg. Co., Waterbury, Conn., offers a high factor of safety for the operator and reduces operator fatigue element. The fastener is grouped in one standard skin fastener plate, the leader inserted in the skin sheet hole, and the leader used to line up the holes in the two skin sheets. The fastener is then compressed and holds into place with a closely wedged "snap". The fastener is composed only of the materials of application and is safe for use in aircraft under 75 pounds per square inch pressure and requires one less rivet to apply, reducing attaching time by 10 percent. Fastener is slender and is no



dragged than final fastener supply looks the set. The Scovill Aircraft Skin Fastener is currently available in sizes #4, #6, and #8 in the holes—Aviation, June, 1942.

Bendix Pressure Valve

A new pressure regulator incorporating an auxiliary poppet-type pilot valve which is adaptable to all pressures from 500 psi. up, has been introduced by Bendix Aviation, 144, North Hollywood, Calif. The regulator which is also known as an "overloading valve" is reported to have been specified for



use on at least four new airplanes. The poppet valve provides absolutely leak-free operation under all conditions and will not "weep" toward



the outside or cut-out pressures. Rather at a high system bleed off or at very low flow conditions there is no appreciable pressure loss or leakage. One of the most interesting features associated to this new type valve is that it will continue normal operation down to at least -40 deg. F. All parts of the regulator are 100 percent interchangeable. Use of the poppet-type valve eliminates allapped fits, which naturally speeds up production and simplifies maintenance and repair work in the field. Service operations are further simplified by the fact that the entire valve assembly can be removed side without disturbing installation or greasing—Aviation, June, 1942.

New GE Dynamotors

A new line of dynamotors for communication and other service in aircraft has been announced by the General Electric Co., Schenectady, N.Y. The dynamotors perform an important task in communications work by raising battery voltage to radio transmitter or receiver voltages. Aircraft obtain their electrical power from generators driven by the main engine of the craft. The new line of GE dynamotors comprises five types, ranging from 20 to 900 watts at input, and from 2 to 300 at output. Features will include, light weight, and relatively uniform ratings and characteristics for future aircraft applications. Each unit is designed to be output from a small frame or. Oscillatable alternating-current supply is kept at a value which insures a minimum of fiber to provide satisfactory operation at the communications equipment. Other features are spiraled armature passageways to reduce noise and vibration, bearing effect, securely held field pole with provision for lubrication and cleaning, and a motor formed from standardized tubing—Aviation, June, 1942.

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Propeller and wood nut club production is the Hartzell plant has multiplied its volume over and over again within the past year. Without any reference of previous standards it is still being increased at a rate which would have been considered beyond the bounds of possibility a few short months ago. We're a war to win!

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SMOOTH?... I'LL SAY SHE IS...!

Test pilot Smith means the ship, of course! And when he says "smooth" . . . he means performance—rate of climb, maneuverability . . .

. . . and that most vital quality—speed!

These few extra M.P.H. that a smooth, frictionless finish can add to a ship's speed



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VALENTINE & COMPANY, INC., 12 EAST 30th STREET, NEW YORK, N.Y.
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MAKERS OF THE FAMOUS VALSPAR FINISHES

Small Induction Motors

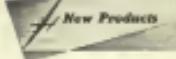
For use on instruments or equipment as a drive for aircraft control equipment, from take-off and lay down, to landing, the 304 series 300 rpm motors, Eastern Air Devices, Inc., 316 Penn St., Brooklyn, N.Y., are able to supply induction motors built to specifications. Illustrated here is a 400 rpm iron sleeve type having a speed of 3000



rpm, operating on 110 v. A plane horsepower at pull-in at 300 and 3000 at pull-out, the torque at pull-in being 5 in.-lb., and at pull-out 30 in.-lb. There are no notches for diameters, reverse run may stop and the motor comes out.—Aviation, June, 1942.

Harness Speed Clamps

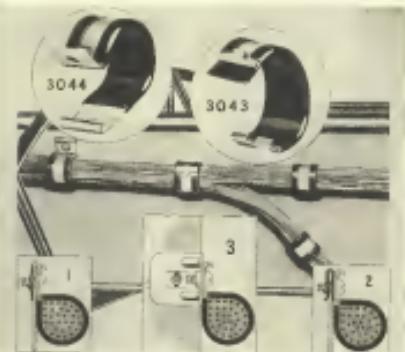
For faster attachment of wires to harnesses in aircraft assembly, two new series of Harness Speed Clamps have been introduced by Timken-Prescott Div., 2078 Palace Road, Cleveland, Ohio. Both types have striking means which prevent holding handles or groups of wires together during installation.



operations and while transporting the wiring to final assembly location. No 3041 series are used at intermediate locations and when groups of wires branch off from the main bundle. No 3041 series are supporting clamps for attachment to intermediate harnesses. Clamps are mounted with integrated metric shankts which provide the cushion. Wire sheathing has made by a prominent testing laboratory, proved that the plastic sheathes will withstand abrasion over ten times longer than materials now used for wire insulation. These methods of attachment are illustrated: (1) With standard Flat Type Speed Clamp; (2) With "D" Type hook and snap hook at one end of flat clamp; (3) With anti-friction Type Speed Safety attachment at various positions of replacement. Both types of Harness Speed Clamps are available in ten different sizes in cross-sectional lengths of wire in group diameters ranging from 1/16 to 1/2 in.—Aviation, June, 1942.

Penn Quick-Action Vice

Quick action plus gripping power are featured in the Penn Quick Action Vice put out by the Penn Mfg. Co., Hurford, Ohio. Instead of a slow hand crank to



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Non-Corrosive Resistant

Rex-Flex Stainless Steel Flexible Tubing is available in five wall-thicknesses, all of which can be combined in a single one-piece length, with straight walls and corrugated sections at desired intervals. Sizes 5/16" I.D. to 2" I.D. incl. Made of 18-8 (Aus-Tech) Stainless Steel. fittings are attached to tube ends by electron resistance welding.

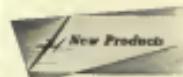
No Rax, No Rass, No Quacking—Preferring Absolutely Tight, Homogeneous Assemblies



Left: Heavy-duty Rapid Heat-Sensitive insulation

Data and Engineering Recommendations on Request

**CHICAGO METAL HOSE
CORPORATION**
MAYWOOD, ILLINOIS



After you pass on the work, a quick action snap lever throws your toolbar instantly, uniformly, solidly; then the eccentric handle locks this work on a deadly secure grip. Uniformity of grip can be judged by clamping two pieces



of paper—50 ft. checkmate at end of the pens. The Quick-Action Vice is adaptable to many scaling, drilling and assembly jobs. All working parts (except bars, wheels &c of fine ground, well annealed iron for heavy duty) are of hardened, ground steel—Aviation, June, 1942.

Portable Soundrecorder

Completely self-contained, including helium microphone, a new portable dictation and recording unit has been developed by the Sounderoller Corp., 42 Anderton St., New Haven, Conn. Providing unusual help on a 20-lb. basis—yours can dictate anywhere at anytime, even while traveling by car or by train where 115 volt A.C. outlets are available—the Sounderoller can even provide a clear tone whether you are standing up or sitting down. There are smooth points to hold, the sensitive radio-type microphone goes every word. Dictation is recorded on ultra-thin disks 7 in. dia., which are positively interchangeable. These record both sides, 35 min. to the side, may be dropped, bent and straightened, walked over, played 100 times without destroying "read tracks." Fifty hours of continuous recording can be filed in a space tenth in—Aviation, June, 1942.



AVIATION, June, 1942



© WALT DISNEY —



CREATED by Walt Disney especially for Beechcraft, as a badge of merit and honor to be awarded to employees of any rank or station. To qualify for the award an employee must have demonstrated, by performance, the qualities of high efficiency, interest in his work and in striving for further advancement, cheerful cooperation with others, and the constant determination to "Kill 'em with Production."

The Beechcraft Busy Bee, rampant on a field of blueprint paper shaped in the form

of a Beech leaf, embodies these qualities. Although this Beechcraft Busy Bee is busy as can be, he's not too busy to look aside to see, if need of two jobs, he can't do three. His studded Beechcraft winged insignia and his cheerful grin are indicative of his high morale, but his determination is written all over his face.

Most Beechcrafters will qualify for this award. With willing spirit and determination they are pushing production rates ever upward.

* Design copyrighted by Walt Disney

BEECH AIRCRAFT CORPORATION • WICHITA, KANSAS, U.S.A.



G-E Aircraft Relay

A sturdy, lightweight relay designed particularly for aircraft applications calling for operation at high altitudes under severe vibration conditions has been announced by the Industrial Division of the General Electric Co., Schenectady, N. Y. Designated CERH-1000A, the relay weighs only 4½ oz., is



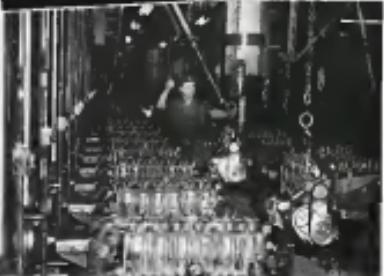
U.S. AIR FORCE AIRCRAFT
NORTH AMERICAN AVIATION INC.

3½ in. long, 2 in. high, and .25 in. wide and can be mounted in any position. It is designed for switching frequencies of 5 to 35 cycles per second at 6 in. maximum amplitude (in an total travel) in any direction. Altitude from sea level to 60,000 ft., and ambient temperature ranging from 60 deg. C to 0° deg. C. Oil within the performance scope of the relay is 100 SAE. The relay has a rated current rating of 50 ma. at 25°C or 24 v. The coil operates at 12 v. The single-pole normally open contacts are designed to close upon when the coil is not reversed and should close when the coil is energized at rated voltage when either subjected to linear acceleration of 30 G or one direction, or to the vibration conditions outlined above. It is driven by a piston, having passed among other legal tests, the Navy's 28 hr. self-spins test—distortion, June, 1942.

RA Unit

Burglars, and a lack of degree of an individual, or building up social unrest, various sections are altered by the Wartech Corp., Harvey, Ill. It is their new Type "RA" Unit. The new apparatus has a ring which slides around the center bearing of certain sections of the engine. Heavy rubber makes the unit provide complete protection to motor bearing. In order to prevent any accessibility to any part of the engine section, either assembly can be rotated 360 deg. in either direction—Automatic, it says.

CURTIS Air Hoists For More Production



Assure Faster, More Efficient Lifting Save Labor, Increase Plant Capacity

Here's the solution for every plant faced with today's demand for increased output and a shortage of skilled labor. Curtis Over-Man Air-Power Hoists make lifting easier, faster, more efficient—allow more for other jobs and reduce man-power fatigue.

Curtis all metal Air Hoists are no more than a thin black, are smooth in action, speedy, and efficient. They provide extreme accuracy of control and can handle the most delicate hoisting operations. Any worker can operate a Curtis Air Hoist—relating skilled labor for other duties—for the hoist does the work by air power. Capacities up to 10 tons.

For complete information as to how you can step up production and lower costs in your plant, write for free Curtis booklet, "How Air Is Being Used in Your Industry."



**Curtis Pneumatic Machinery Division
of Curtis Manufacturing Company**

1937 Kountz Avenue St. Louis, Missouri

Low pressure Air Hoist-Curtis
Model "C" Capacity 1 Ton
Hoist Weight

Hoist Handling Unit and Curtis
Pneumatic Lifting Grinder



HOW MANY FOOT CANDLES FROM HERE TO VICTORY?

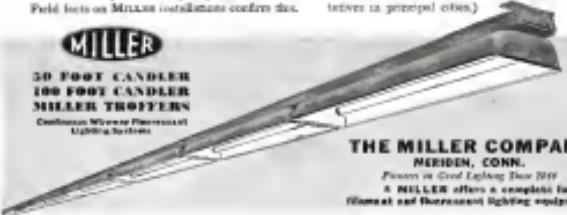
TODAY better working daylight is a major offensive weapon. MILLER Continuous Winway Fluorescent Lighting System provides it . . . 50 foot candle, 100 or better, to speed production . . . plus noteworthy savings in power, dollars, man-hours and critical metal.

MILLER 50 FOOT CANDLER AND 100 FOOT CANDLER will put 50 foot candles, 100 or better on every working surface in your plant. MILLER THEORIES will duplicate that performance in your plant office and drafting room.

Science says your men will work better, faster, more accurately under this quality of illumination. Field tests on MILLER installations confirm this.



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Continuous Winway Fluorescent
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filament and fluorescent lighting equipment

AVIATION June 1942

TO MEN OF VISION

It takes a keen sense of honesty and perspective to appreciate what men of vision have done... to realize how they parted their time, fortune and blood against the odds... to understand the value of wood and fiber and stone.

Aeronautics has stressed the vision of its creators. It has never been satisfied with standing pat on existing technologies. And so, with new ideas, new materials have been tried... plastics, for example.

SYNTHANE CORPORATION, OAKS, PA.



You are looking at the Army's first military airplane (Wright) mounted atop a wagon in the parade grounds, Fort Meade, Va., during the year 1908. (Photograph courtesy of Army Signal)



First commercial "pusher-type" airplane in the country. Built by Wrights in Wisconsin in 1911. Previously all American planes were "pushers" with engine and propeller at the rear of the plane.



The Fokker G.III hydroplane with which Robert C. Johnson made the first crossing of the Atlantic Ocean of Panama on April 1912. Fokker's aircraft of gasoline and had a record "straight" landing.

SYNTHANE

TECHNICAL PLASTICS

SYNTHANE
Resists - Burns - Tears - Abrasive Parts - Heat Resistant for Rating

MATERIALS TO REMEMBER, SPECIFY AND USE FOR AIRCRAFT PARTS

**THE AVIATION INDUSTRY
OR'S SYNTHANE**
Resists - Burns - Tears - Abrasive Parts - Heat Resistant for Rating

SYNTHANE
Resists - Burns - Tears - Abrasive Parts - Heat Resistant for Rating



Seven Tubing

Suitable for a variety of applications, including fuel and air lines, hoses and wire, has been developed by **Austin Sheppach Products Div., Western Flyer Works, 6135 Ogden Ave., Chicago, Ill.**, may have a specific use in a number of design fields in aircraft, as an air canister, in insulation, as a strong support in wings and tail. A thermoplastic resin having a specific gravity of 1.0175, a tensile strength up to 40,000 psi, and heat resistance (duration end) of 1000 deg. F.—the working point being between 210-220 deg. F. Resin may be available in standard packages, and extended shapes. Tubing and sheets are made for the purpose of substituting for copper and the like materials, but modified for use as gasoline floats, gaskets and rheostats. In sheet form it may be a roll for electrical tank linings, capacitor plates, etc. It is meant as an aid to corrosion effects as the majority of aircraft materials are subject to some form of oxidation or deterioration. For short periods of time, for example, when tubes of 1/4 in. od. and 605 as well as 1/2 in. dia. or larger are held at 213 deg. F. and subjected to 260 psi, no permanent damage results. **Austin Sheppach Products** has been licensed by **Globe Chemical Co.** to fabricate this interesting resin into the various forms.—*Watson, June, 1942*.

of holder. Total long deionizing time is set from hours to minutes. All that is necessary is to lock holder in position and in T-shaped plate and start pumping. No further adjustment required. After treatment, the treated material may be given practically saturated patterns.—*Watson, June, 1942*.

UE-3 Transceiver

Model UE-3 Holophane self-contained ultra high frequency transceiver, which up to present time has been sold exclusively to foreign governments, is now available to U.S. Government. It is manufactured according to standard plans and drawings. Tubing and sheets are made for the purpose of substituting for copper and the like materials, but modified for use as gasoline floats, gaskets and rheostats. In sheet form it may be a roll for electrical tank linings, capacitor plates, etc. It is meant as an aid to corrosion effects as the majority of aircraft materials are subject to some form of oxidation or deterioration. For short periods of time, for example, when tubes of 1/4 in. od. and 605 as well as 1/2 in. dia. or larger are held at 213 deg. F. and subjected to 260 psi, no permanent damage results. **Austin Sheppach Products** has been licensed by **Globe Chemical Co.** to fabricate this interesting resin into the various forms.—*Watson, June, 1942*.



Wales Punch, Die Holder

A new model Wales Punch and Die Holder that punches holes per cent has been announced by the **Stapco Corp., 1300 Niagara St., Buffalo, N.Y.** This new self-contained die holder permits easy holes for riveting small parts, to fixtures or to the material. With Wales Punch reduced holes to be punched in a series line, it is set aside according to the setup of holders on rods or T-shaped plates. Nothing is attached to the rear of the punch. With punch and die held onto the same holder, one hand alignment is assured for the life



volume control and "knock" switch, as well as cut-off switch. Included, as standard equipment, is the essential military-type screw which provides pockets for handle, antenna and battery cable. Complete removal of cover



is unnecessary, operation of set being performed by merely initiating the front key.—*Watson, June, 1942*.

Air Corps Type Switch

A new Air Corps type switch designed to meet requirements of the Air Corps specification, 98-08240, is announced by **The McBratton Corp., 2010 Maricopa, Phoenix, Ariz.** Assembly consists of a three-pole transmitter working in the 60 to 75 kc frequency range. Contacts of carbonized plated steel, and point of styled chrome plated steel includes a frequency control trim,

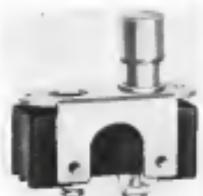
and a ring type wave selection. New type construction will be superior to old style Air Corps assemblies because no over plunger mechanism was formerly mounted directly on balance switch itself. Much stronger construction is now available with mechanism directly attached to the wave selector.—*Watson, June, 1942*.

Air Hose Couplers

Designed to permit instant coupling and uncoupling of air hoses, an automatic "plug-in type" coupler is offered by **Air Equipment Corp., Bronx, N.Y.** To connect the coupling, merely "push on" by inserting the plug into the female fitting. When the male is inserted, and when the valve is turned clockwise to release and "pull off," the coupling will be completely detached without leakage. Due to the built-in automatic shut-off valve which already contains the seal, it is said there is no leakage at any time. Full pressure is retained initially when coupling is connected; the moment it is dis-



connected is an instant platen and piston which is rapidly withdrawn to prevent platen from hitting the housing and causing damage. The piston is held in place until it is again inserted. Pistons required to operate in sets is 2 1/8 inches and 5 3/8 inches over entire operating range. Electrical rating is 30 amps. at 20 v., d.c.; 17 amps. at 220 v., a.c., and 9.5 amps. at 220 v., a.c. non-inductive loads. Wings, rotors, propellers can be supplied manually open, closed, or closed single pole, should these not be spaced correctly, data are provided on bottom of centre to allow



For AIRCRAFT PRODUCTION EXECUTIVES:
How to Plan the Most Efficient Plant Lighting
How to Get the Full Results of Your Planning
How to Figure Cost, Maintenance, Installation

This Book is Yours for the Asking



It is a fact that many new plants now in war production are operating with a fraction (one half to one-half) of the illumination for which they planned and paid. This work is unnecessary.

The new book "LIGHTING FOR THE AIRCRAFT INDUSTRY" contains:
• Comparative information on *present* and *newer* lighting methods.

- Accurate tables for arriving at *safe* and *economic* components of various lighting methods.
- Easy-to-use dimension sheets (available for the first time) which give *per determined* information of expected lighting results.
- Standard tables for ten important reference banks, prepared by the Holophane Engineering Department. Pic. change

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Helpful Staff Work

IN THE BATTLE OF PRODUCTION

All over America, engineers and production men are working glows to war needs. These men know they can—given reason—and they are giving reason to every effort to speed up the working of tanks and aircraft.

The helpful assistance has been mobilized into component charts, pamphlets and other printed pieces. These tools help to passage from technical thus to suggests to rough to experts on production. To facilitate communications, special publications are issued.

Here, also, are correlated latest reports from the field about advances, difficulties and uses of various and numerous Nickel Alloys.

And, as further support for your battle of production, we offer general assistance from metallurgists and technical staff. With recent experience in many places during immediate difficulties, these men know especially helpful. During warms, Nickel...and its friends like Nickel...mean go where it best serves the United Nations.

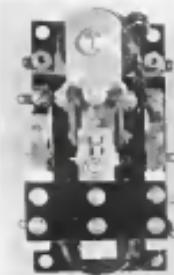
★ ★ Nickel

THE INTERNATIONAL NICKEL COMPANY, INC.
37 WALL STREET
NEW YORK, N.Y.

Dunco Reset Relay

A new mechanical switch, electrical reset relay especially designed for aircraft purposes and controls, tested to meet requirements of the U.S. Army Air Service has been manufactured by Dunco Electronics, Inc., 2600 Oberlin St., Philadelphia, Pa. Known as Dunco Relay Type

Burbank, Calif. It is enclosed in a removable, reinforced, welded steel case, 30 in. high, 30 in. wide, and 40 in. deep, and can be used either for bench or stand mounting. The case is finished with a standard snap fastener. All terminals, resistors, instruments and controls are mounted on a vertical printed panel at the front of the test unit. With the exception of the resistors and controls, all other components of the case are within the cabinet. A one piece cover is easily removed to give quick access to the interior for inspection and servicing. The test unit can be used to test aircraft and ground equipment, standard and low voltage generators, all models; Curtiss electric generators, all types of direct and double shaft aircraft models, and Curtiss proportional type governors—Aviation, June, 1942.



C22190, this unit operates from a brief impulse without the necessity of holding. It is solid state, double-pole, double-throw contacts, rated at 10 amp. at 12 or 28 v. d.c. or ac. Auxiliary contact blocks are self-circuit. All contacts are insulated from the frame for radio noise. Dimensions of the test unit are 31 in. x 14 in. x 10 in. weight of 100 lb. Capacity also furnished taking in special cases, configurations,

Wiremold Flexible Tubing

Recommended for electrical wiring on airplanes and also used as a protective covering for fuel and oil lines, Wiremold flexible seamless woven tubing is made by the Wurmold Co., Hartford, Conn. Taking of standard sizes and standard and standard finish ranges in sizes from 3/16 in. to 1 in. in. in multiples of 6 ft. Company also furnishes tubing in special sizes, configurations,

tubing is used as a protection covering for wires, fuel lines etc. The Wiremold flexible tubing has passed a suitable insulation—Aviation, June, 1942.

WINDOW SHOPPING

Altimeter. New edition of A-1000 standard altimeter, Model A-1000, is now available.

Tire Gauge. Popular tire gauge has been redesigned by Goodyear, a self-tensioning wheel gauge that measures pressure in pounds per square inch. It is a dial gauge with a scale graduated at one pound increments. Scale and dial are graduated by 1/10 of a pound. Price, \$1.75. Model A-1000. Los Angeles, Calif.

Emergency Boxes. First-aid kit for use in airplane emergency cases has been redesigned by the W. F. P. Emergency Box Co., Inc., 1000 S. Western Ave., Los Angeles, Calif. The new boxes are made of aluminum and the vital parts are contained in a separate box which is optional for use. W. F. P. Emergency Co.

Vibration Velocity Phaser Drive. The increasing vibration problem in aircraft has led to the development of a vibration velocity phaser drive. It is a solid state device developed by the Research Department of the Westinghouse Electric Corp., East Pittsburgh, Pa.

Metal Drawing in Warships. Increasing the strength of ships by metal drawing is a method being used in the production of armor plate. The metal products have been used in the construction of ships, aircraft carriers, battleships and destroyers.

High Altitude Fuel. New—NATE 20 of the new fuel developed by the Standard Oil Co. for high altitude aircraft. In my hours spent in the development of the new fuel, I have found NATE 20 to be superior to all other fuels.

Reinforced Fiberglass. Fiberglass, a composite material consisting of glass fibers and resinous materials, has been used to reinforce aircraft skins, fuselages, wings, engines and armament. Strengths of 10,000 lbs. per sq. in. are obtainable.

Quonset Sheds. Quonset—up to now, the most popular type of temporary shelter.



AVIATION June, 1942



and finishes to meet specific requirements. When rapidity and thoroughness, as well as flexibility as required, company has made a specialty of developing tubing with wire-filter, Corp. of America, Alabama, Texas or Florida, and when ratios of materials



tubing is used as a protection covering for wires, fuel lines etc. The Wiremold flexible tubing has passed a suitable insulation—Aviation, June, 1942.

AVIATION June, 1942

NO SOONER SAID



than Done



THIS BROCHURE will tell you more about the War Production Staff. It's the men who at Lyon facilities can help him expedite his war contracts. And it may be just the answer.

**MORE THAN A YEAR'S EXPERIENCE EXPEDITING
WAR CONTRACTS FOR FABRICATED METAL PARTS**

● Organization and experience are the two primary factors responsible for Lyon's ability to move fast and effectively at each step in the handling of War Contracts and Sub-Contracts for unusual fabricated sheet metal products.

Lyon field men are specially trained to gather all pertinent facts for submitting our facilities with your needs. At daily meetings of our War Production Staff—where all major departments are represented—plans are laid and synchronized for speedy handling of every commitment. Wall into its second year of continuous operation, Lyon's War Production Staff provides a working knowledge of War Order Requirements and Procedures difficult to duplicate.

Ready to advance the staff's plans into production is one of America's best equipped

organizations for fabricating sheet metal. Lyon's big, modern plants cover an area of over half a million square feet. Completely equipped toolshops assure prompt production and maintenance of all necessary dies and jigs.

So, if you have products or parts of products to be made for Uncle Sam that require fabrication of No 8 to No 30 gauge sheet steel... turn to LYON for ACTION. We have the facilities to make such products in large quantities... to have them ready when you need them. Write for brochure, "Craftsmen in War Production."

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LYON METAL PRODUCTS, INCORPORATED



New Opportunities For Subcontractors

Loan Regulation Liberalized to Aid Conversion

THE NEED for subcontracting continues to grow. Increasing evidence of this fact is apparent despite the existing short-term defense conversion plan that American industry has performed in a few short months.

The following information is provided by the new government financing regulations which make it easier for both rate and prime contractors capable of subcontracting to the war effort to secure needed capital.

Such material may be viewed under Reg. 14100. V-1. WPS reports, similarly broad loans may be made to subcontractors under authority of the War or Navy Departments or the Maritime Commission.

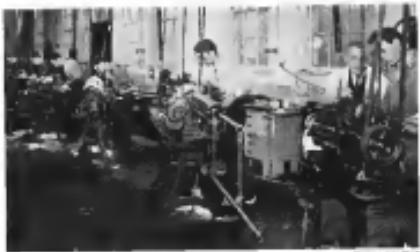
One of the chief objectives of the new plan, WPS reports, is to provide

for the financing of war contracts which may be awarded to companies that lack sufficient capital, but that are otherwise equipped to handle the work. For instance, a subcontractor may have a plant located in a remote section from present-day war-time production and may also have management that is sufficiently capable and responsible to handle such contracts.

In the absence of lack of capital, such companies may be enabled to take part in war production.

This new method of financing will enable such companies to participate in the war effort and will expand their areas of war work and increase utilization of the country will be instrumental in handling such financing.

According to a release of the WPS Bureau of Finance, such loans will



SUBCONTRACTING GOES TO COLLEGE

Parker University students again were rolling belts, grinding parts for war machines. Recently only a portion of the engineering students, it is now a war factory under terms of a contract with the University by Washington. The American College Board of Education, together with the Association of American Colleges, has established a college unit offering vocational engineering courses among 117 schools giving civil, electrical or mechanical—or all three—courses, covering availability of such mass equipment similar to that shown.

• Results in plant size plant grows there Lyon Steel Shop Equipment seems metallic to former output. They reduce time, advantages and reduce losses in some areas may be increased by permitting the increasing and use of tools and every second by systematic reworking of



Steel Furniture Dept.
Div. of WPS

LYON Service
Steel Furniture Dept.

over a maximum interest rate of 5 percent and, in many cases, it is expected aircraft interest will not exceed a rate of 6 percent.

Aircraft Contractors Offer

Meanwhile, contractors from time to time operations have continued at an accelerating pace, WPA reports. A company which manufactured paper bag and box making machinery raised its estimate of the need of subcontractors over two years ago; the first time when was issued a year later, indicating the backlog of a variety of both

and parts for an anticipated plane contractor. Some 100 of the estimated aircraft contractors include a \$10,000 order for aircraft engine test stands and the manufacture of a variety of fixtures for airplane engine field maintenance and repair.

Another recent announcement came by the board of a small fabricator of precision hardware for aircraft contractors now engaged in certain aircraft electrical insulation parts for aircraft and aircraft engines or additions to aircraft existing to correct or place subcontracts.

Idle Machinery Wants War Work

The following, an herald edition, are manufacturing facilities, with their locations, recently offered to the aircraft industry through this publication. Readers will be glad to forward promptly to the interested firms inquiries from agents or subcontractors who want more detailed information on the manufacturing facilities listed. Similar notices in other issues are available both in our regular columns or in addition to our twice weekly mailing to correct or place subcontracts.

102 New York City—Special machinery manufacturers, capacity 30,000 sq ft available for light metal work, plant fully equipped with modern tools.

103 Los Angeles City, Calif.—Manufacturer of reading machines. Its plant 30,000 sq ft, available. Modern machine and sheet metal shops.

104 Indianapolis, Ind.—Manufacturer of aircraft. Equipped to produce complete assemblies or special job parts.

105 Chicago, Ill.—Manufacturer of aircraft components, sheet metal, riveted, metal working, and metal working shops, equipped to produce aircraft assemblies.

106 Milwaukee, Wis.—Manufacturer of aircraft handling equipment, now working on power and subcontracting on

hand additional work, complete sheet metal working equipment.

260 Chicago, Ill.—Metal working facility, machine shop and sheet metal shop, tool room, equipped to produce small stampings, rolled shapes, tubing, special tooling, and assembly work.

307 Milwaukee, Wis.—Experimental workshop; 10,000 sq ft of production area, equipped to produce wood and plywood parts.

308 Chicago, Ill.—Manufacture of core controlled camming and variable pitch propellers, also aircraft landing equipment for small aircraft assemblies such as position bases or water recovery work. Equipment in Illinois, Indiana and South Bend, Indiana, a factory and small aircraft assembly, head parts, auxiliary supports, and prop and drive gears.

309 Memphis, Tenn., Calif.—Manufacturer of aircraft hydraulic control assemblies and accessories in quantities up to present plant capacity. Additional facilities are being planned to meet increased production demands. Company has long experience in the manufacture of pressure parts of all types, including those that are required for highly rotating hydraulic controlling mechanisms. Acting as suppliers of many types, including wings, fuselage, rear wheel, landing gear, tank cars, etc., are being soon turned on a productive basis.

Inquiries should be addressed to Advertising, 220 W. 42nd St., New York, containing the item numbers shown above.

Aircraft Subcontractors

The WPA Production Board is seeking subcontractors for items of aircraft parts, detailed preferences which may be obtained at any of the WPA Contract Distribution Offices.

Among those sought are subcontractors for aircraft parts which require a 100-ton automatic screw machine, No. 42 & 8, lead screw; arbor press; gear

motor, traveling machine, drill press and vertical and horizontal grinders.

Another prime contractor needs a shop with 40 in. Cleveland automatic wire wheels.

A subcontractor is sought to make aircraft turnings and batches of stainless steel stock which can be purchased from the prime contractor, while another manufacturer wants a subcontractor to make and roller blades. An aircraft fuel pump.



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Information



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CHAMOIS	WING COVERS
CRASH PADS	FUEL LINE COVERS
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SEATS	FLEXIBLE BLIND REND CUSHIONS
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engineered, ruggedly-constructed, low cost carts, ideally matched to the requirements of parcel delivery.



WCA Model AVIS-100 and AVIS-140 Receivers—Finally a handset, yet the AVIS-100 is a receiver. It found super-SDR receivers with matching performance. Comes 350-450 kilohertz West Wave, Western band, and 130-1500 kilohertz Western band. Energy consumed is equivalent to A.M. or SSB with 100 watts output, or 500 as package compactness. Model AVIS-100 is a receiver but covers only the 350-450 kilohertz, FRS, GMRS, and GMRS-II bands.

本节结束，我们已经掌握了如何使用



ECA Model AVB-15 (Electro—
magnetic) along with over the
trunkline "switches" made
these—constitutes a separate Traffic
Control System to put you
easily on the Traffic Control Frequency regardless of the
status of the radio transceivers used.



RCA Model ATR-121 Transmitter operates from 1.5 to 100 MHz through optional ANA-121 Wireless Power Supply which also permits ANR-100, AWR-100 or ATR-10 transmitters to utilize two-band transmitters.



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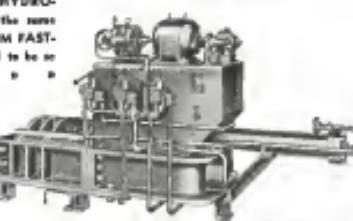
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• AS EVERYBODY KNOWS, said inside name comes from model barn. Introducing a fresh note into this informative page, we give you the first and only news item originating in schools.

One of the girls in our older group to school, and she got it from her mother, who got it from another mother, who got it from a relative.

Broad Haze was Mrs. Miles and told him she had seen a Democracy mold was, and that peace ought to be made with England at once.

The male Hitler said, and he gave him the cold eye and said in a few snappy words: "You go home and tell 'em and get out!"

So Hitler called up Paul Maserinhardt and told him what a fit he was in his Park Lane flat because of his famous Wrights in the sky by Berlin.

And then Maserinhardt disappeared,

and hasn't been seen or heard of since.

And, then was right Hitler did come to get him—with an armed squad—to late. That's hot off the press.

• NINETEEN FORTY TWO, as far as we know, is the first year in which anybody can look forward to getting an extension to the road. The main cause of the extension is that there is no winter under, and length the whole year.

But this year, a lot of people actually wanted for a certain calendar. It was Thompson Prudak, who issued last year with series of 22 pictures of planes of the first decade of this century.

Thompson left the job just before in 1942, with a series called "The Golden Decade"—1903-1938. It begins with the Wrights' 1903 flight, ends with the first transatlantic mail, and ends with the Question Mark, 1936.

This new job, and the first one too, were done by Charles H. Shabot, of Fairview Village, Ohio. Dandy you find two kinds of airplane stories one who can make them look as if they had a soul and were going somewhere, and the other who can make them absolutely nowhere. Mr. Shabot is one of the few who does both.

• NEXT TO THE LAST of the amateur pictures in the Ford Tax Gauge Testoster of the late '20s and early '30s it is hardly fair to end the Ford with the early '30s either, as most people do, for it is still flying in several parts of

the world. We have two vital members of the Ford plane.

One of these names was on the sign post in Arizona, known to tourists as the "Painted Desert." We were writing some desultory literature at the time, short stories, and a company that owned a Ford took us, and some more people, out into the painted desert to look for the signs. We looked for what passed for an aeronautic legend and camped off sage by the Indians and quite a number of Hopis came out to look us over.

One of the Indians was an Indian woman who looked to be about 500 years old. It soon became apparent that she was blind, for she began hitting the airplane—wheels, wings, propellers, all

the while guided by an old man, who followed us to constantly.

After we had gone all over the ship, she made some remark and the old man laughed. We asked him what she said, and he replied, "She says it has no timbers."

• OUR ONLY REGRET is that Timucuan passed by the World War desultory planes. We have a good idea why did it because no American planes figured in that war, but we do hope they will get around to it some off-year in the future. We want to see some of those rotary engines that blew crater oil in our face.



The Assembly Line is Moving So Fast Poor Mr. Major Can't Keep Up With It!



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HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

AVIATION, June 1942



Piston indicates large amount of sealant required at both end seals, making possible sealing of collector pipe or engine structure independently of engine.



Confined spaces are places where material for sealant work, like the worker's sweater or part being worked, provide minute sealing of each operator's nose.

Service Problems of Aircraft Engine Exhaust Systems

By
JACK C. ZIPPWALD
Wright Service Representative,
Sperry Aircraft Co.

The system must be made to operate in the presence of large amounts of heat, as a source of often heat and embrittlement of heat, and some experimentation has been conducted on the use of exhaust gases for cooling by warming the engine.

Because every airplane model has a different exhaust system, the theoretical problems are great and the actual datum are few; therefore, service engineers have the difficult problem of solving an enormous number of parts. To overcome this handicap, a program investigation has been undertaken and the manufacturer has been properly made available to the exhaust engineer.

Yield strength of exhaust engine parts simply performs its primary function, that of carrying away body engine exhaust gases. Actually, it performs other tasks to enable high performance in an airplane.

Today—the slip joint type and the bell and socket type are considered as standard by the Ryan Aeroplane Company. Each type has its particular service problems and must be taken care of separately.

Slip Joint Construction

An analysis of the slip joint type is easily feasible through a study of the various parts as separate from the engine part in the exhaust outlet. First part to be considered is the port nipple. In some cases this part is integral with the collector ring body, but in two new installations, at least half of the port nipples are separate parts. The port nipple organizes the outer weight of the collector ring and is subject to extremely high temperatures due to the heat of the engine and vibration due to engine vibration and movement.

There are two general types of col-

lectors, service problems include



Proper sizing of welds after welding to check is important to prevent loss of joints.



General inspection of expansion gap and face and side surfaces from edge of hub casting and edge of hub spine is extremely important to prevent pinching of joints.

Make the detectable marks permitting inspection marks without removing surface from inspection.



marks in the metal; failure of part connecting attachments, and wear of the relative body at stressed point. Cracks usually appear near the engine part and the rest of the total damage. These cracks can be caused by fatigue, and the engine part will be more susceptible if the fatigue or cracked area is covered with a patch or doubler, after welding the cracks.

Failure of part connecting attachments usually occurs when the engine has single shaft extension parts. Four and three bolt flange type parts sometimes very seldom fail but less so because in some cases the addition of triangular countersunk holes to the top of the hub is taken to prevent cracking of the hub adjacent to the flange. In this case of the single hub attachment it is necessary for the manufacturer to have a stop and weld it to the base. These parts are subject to cracking unless the hold down nuts which may be secured through addition of a shoulder, riveting adjacent to the weld, which may be helped through use of a larger gauge material, and not later corrected by grinding the shoulder off and cut out of the hub, in which case a chip with a larger burr should be used. Repairs by welding, riveting and patching are all short temporary measures, instead of replacement of the hub or hub with heavier material, and a possible repeat for damage on future parts.

The wear or galling of the collector bush at its bottom point is due to vibration of the collector ring. Although it is not possible to eliminate it entirely it can be reduced in keeping the collector bush in the present service and adjusted so that it will have a tendency to move in and out instead of an oscillating pattern. Wear marks usually occur at welded or cast welds on parts, and add service life to parts. There may be reasons to do this, the spots are growing the work, and should be replaced by the same methods as the originals. Galling may be avoided, but not eliminated, by smoothing the welded surfaces.

Collector Cables

Consideration is next given to cables, both those used for connecting parts and those used for connecting the collector ring sections. In some designs these parts are situated by themselves on one side of the collector ring, and in other types, placed against headers, and double headers. The plain and single headed cables allow for skipping while the double headed cable must for rigid connection.

These parts are subject to wear and galling where skipping occurs, failure of lead wires, failure of aluminum digits in the case of plain cables and failure of aluminum leads.

Worn cables should be replaced under

ordinary service conditions, though in emergencies they may be pushed. Metal may be kept to a minimum by keeping the cables, as well as the mounting parts, properly used to minimize proper design.

With tubes, unless fast if properly welded, or some means due to misalignment or insufficient penetration of the weld, they may crack off. Both failures may be repaired by grinding the weld from the solder and welding a new bolt tube plate. The solder should may be used as a tie by inserting the bolts and welding the new bolt into place.

Attaching stops, used for holding single cables in the proper position, are found to crack usually at the point where the part is bent or forming. These parts may be repaired by welding or replacement of the stop. Failure of cracking is relieved by assistance of jigs and alignment of the cables and the collector as against increased vibration. Failures after proper repair may have been taken calls for a heavier gauge material or a different type of stop.

In numerous cases it is found that the leads fail to serve, due to absence of any provision to negotiate installation. The attaching bolts are of small diameter and most not enabled to grip tightly at a tension before they shear when the solder burns up and expands in operation. These bolts should be tightened very little beyond finger tightness for a firm grip. In any case solder nuts and washers or otherwise, may need to be replaced whenever damage is suffered. Once continual failure of nickel clad bolts occurs it is sometimes possible to alleviate this by using a weight iron bullet as they will take a greater vibration before failing.

Collector ring body sections are subject to cracking at the joint points, wear of the collector pads, and bearing cracks, when they occur, are erratic.

Proper size of joining machine settings must be maintained to keep proper clearance for joining cables.



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BOEING

178

AVIATION June 1942

located around the port inlet. In some cases the port inlet is sealed to the main body, otherwise it is formed in one piece with the body. These cracks may be repaired by welding. In some cases the port inlet is so designed that a leather gasket material should be used for the port inlet so as to reduce the heat losses of the port below the inlet heat.

Wires cannot be entirely eliminated but may be reduced by proper service and maintenance. Galling may be relieved by smoothing the galled surface each time the collector is serviced. When wires are used, they may be replaced after they have served. When they are not used, the setons should be replaced.

Breaking of collector ring solder wires has some collectors have "hot spots" on the air side of the collector opposite the port inlet where the direct flame of an exhaust port may blow directly against it. Under some conditions of engine operation the temperature of the flame at high temperatures to the metal. Temporary repairs may be made by welding a patch over the damaged area. The fair air side of the port should be revised to eliminate this condition.

Service problems for outlet sections are essentially the same as those for collector ring sections except that cracks sometimes appear in the body of the section due to stresses caused by a long monopropellant nozzle. These cracks are usually longitudinal and may be made to give additional support in the outlet either by strengthening the section or the addition of auxiliary supports. Care should be taken not to restrict the movement of the outlet, other wise the support will do as much harm as it does good.

Intake tubes are often installed in collector rings or air pipes as a source of moisture for the engine heat. Proper air warming are found in most problems. Dismantling of the exhaust gases on these tubes causes pitting of the metal. Attention of putting vapor with the type of fuel used. It is impossible to go back with low and constant to eliminate as much as possible the pitting of these parts as well as the vibrations themselves. These parts are not to repeat especially when the aircraft is flying at low altitude. They should be replaced to prevent the damage of putting entirely through before the next service period. Wear of these parts may be reduced by proper alignment and fit.

In place of an aluminum tube rear collector insulation can be equipped with a mesh or a coarse of exhaust heat. This mesh is inserted a short surrounding the collector rear part of the propeller with position for the uptake of cold air and exhaust of hot air. These problems are not existing. Gaskets should be repaired by welding. The mesh should be made in the rear entrance of the collector. The mesh should be cleaned frequently to reduce the carbon vibration to a minimum.

The slip joint type collector exhaust system should be removed, inspected, and serviced every major overhaul period. The exhaust should be removed and simplified lightly to clean the parts. Care should be taken not to handle parts too easily as it is possible to blast a hole in the metal in a very few seconds.

The collector rear parts should then be inspected for erosion and worn spots. After repairing as outlined above, the welded parts should be lightly sandblasted to clean them. The parts should then be aligned and made to proper dimensions to be remounted by the main fairings. After the repriming and service work is done, the parts should be passivated, if the material is stainless steel, because it is not magnetic. This process preserves the passive resistance of stainless steel and will reduce the pitting caused by corrosive exhaust gases.

After repriming, longer service life will be possible if collector is installed properly with regard to alignment and fits at the joints.

Boil and Solder Collectors

Different service problems are encountered in the boil and solder type collectors. Boilants, insulation or piping due to exhaust gases and the problems relative to insulation taken are common to both types.

The boil and solder type collector is mounted on the engine mount as well as through a series of links. In this way the collector does not move with the engine but is stationary with the engine structure, and effectively protects the rear of engine trouble. The engine movement and vibration is taken up as the boil and solder joints located between the collector and the engine part.

The prop pipe is protruding, inside front. Due to the lack of strain imposed on this part, there is no trouble due to cracking or failure of whatever fittings are used. The rear of this part should be checked for any weak areas or potential sources of increasing vibration and vibration.

The connecting link is straight with a spherical socket, containing a half set nut end. This part is subject to wear at the half end, and bending of the half ending in the socket.

Under proper operating conditions wear is very slight, but when insufficient intake regulation is adopted the, the half ending is pressed around the arm of the socket causing wear at the engine water and vibration. This wear may be pre-

dicted joint type available. Note extremely long secondary heat exchanger heat legs on port collector subject to cutting out due to cracking.



Assembly of collector ring sections must be perfect before installing fittings to attach exhaust sections.

Careful alignment inspection of manifold is very important to insure proper fit on engine.



AVIATION June 1942

179

vented by proper installation. However, once the part is worn through it is necessary to replace it.

Under some operating conditions it is found that the most iron bell will correlate and work out in extreme cases three or four times in the socket, requiring the return of the part. When this condition is discovered the connecting tube should be removed and the bell cleaned with a wire brush and then re-fitted if possible.

All the needles on one part that are used should be checked for use on the aircraft and, if used, if necessary, cleaned and remodeled.

Predrawn graphite can be used as a lubricant to aid the action of the joint if it is not recommended that these bolts

be removed from the socket without the use of solvents to save the socket. Therefore to save wear prevent this corrosion and replace.

This should be taken to go back with a few small amounts. In cases where these bolts continue to corrode and leak, serial shop and over holt, different graphite corrosion resistance, may be substituted.

The shop collar is not used in all installations but when employed, it is an important part. It is used to hold the bell more firmly and securely than the bell joints themselves or the collector ring body itself.

When in operation it holds the bell joints in their proper position by acting as a spacer. It allows for the lesser expansion of bell and socket joint assembly. Failure to allow this expansion results rapid wear of the bell sockets.

The six wire grubpins on shop outlets are used. The six nuts have the proper clearance to allow them to turn on the connecting tube when installed. The connecting point is checked to gear existing between the collar and its land radius. If this gap is less than that specified by the manufacturer, steps should be taken to obtain at proper installation of the collector ring as a whole, so if warpage has taken place so that it is not possible to tighten the nut, the nut should be increased to at least the minimum recommended clearance.

The coil socket is usually welded to the collector ring body but in some cases

Proper amount of lubrication of fasteners is basic to assure proper bolt protrusion and ease fine of welding rod.

Properly constructed needle sealing must be able to withstand vibration or impact due to high influences in a mission.

is instead or by a machined joint. The severe problems for this part are related to those mentioned for the connecting tube.

The collector ring body itself is built in a complete ring divided usually into three sections bolted together. Severe problems are few, since the part is mounted on the surface structure. There are no slip joints or moving parts to such excepted joints as would be induced by the use of nuts. Clearance is a factor in holding the collector ring body which permit it to change diameter. The stresses and strains introduced through the bell joints by engine vibration and movement are extremely low.

The only problems associated with this type of fitting and housing in the region of hot spots. Fitting can be eliminated by use of proper joints and the use of such items as shims and washers of flexible design. However, bearing can be repaired by positioning on the root of slip joint type exhaust collector.

The bell and socket type exhaust coil former requires very little service and the replacement of parts is low. The bell joints should be removed, checked, and cleaned if necessary at each major overhaul period. When worn, these parts should be replaced.

The newer style bell and socket joint extended features have the added feature of the mechanical attachment of the rear socket which provides many advantages. In the case of the collector ring, however, it is necessary for additional corrosion resistance without endangering the bell fittings. This new type collector also permits the removal and replacement of any of the bell parts that may be worn or become erratic as a matter of necessity. Is this why regular shooting and servicing are so often performed with the turning up the airplane?

Problems of exhaust turbo collector installations are identical to those already covered except since none need be taken in calculations and fits as heretofore as certain for that particular type. In slip joint type collectors the mounting collars are sometimes packed with mastic packing which must be checked and replaced when worn. Some manufacturers prefer to use a special tapered lock, held in place with springs to keep movement and vibration of the collector ring from the exhaust system. The springs should be replaced regularly to prevent the joint from enlarging as the springs are subject to fatigue due to the heat of the system. The bell and socket type collector has an special service problem in like particular type of installation.



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AVIATION, June 1942



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AVIATION June 1950

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<input type="checkbox"/> Instrument Landing	<input type="checkbox"/> Personnel Training
<input type="checkbox"/> Aircraft Design	<input type="checkbox"/> Propulsion
<input type="checkbox"/> Aircraft Mechanics	<input type="checkbox"/> Structural Mechanics
<input type="checkbox"/> Aircraft Weight	<input type="checkbox"/> Test Engineering
<input type="checkbox"/> Aircraft Wind Tunnel	<input type="checkbox"/> Weather and Instrument Tech. Co.

Training the Customers

A special customer service organization, headed at its head by three Captains and service personnel of both United States and British Air Forces in operation and maintenance of Lockheed and Vought planes has been put in operation by the two managers.

Ground crew work right in the factories under supervision of mechanics, and Air Force pilots receive training from Lockheed test pilots. Under the program, which is a continuation of Major E. A. L. Maitland's work for the R.A.F. and Royal Australian Air Forces have reached the plants for training in Lockheed and Vought bombers and Lightning aircrafts. Also at the plant have been British Air Force personnel for operation and maintenance training on Lockheed purchased by their government.

In addition to the home service, Lockheed has sent men abroad, including test pilot, Louis Parker, who worked both at Singapore and Australia, and Elmer McLean, who went to South Africa.

AAF To Factory Schools

Army Air Forces mechanics are learning repair and maintenance by first hand experience in the factories producing the planes and flying them in the field.

Under a nation wide program set up by the Army and selected manufacturers, mechanics purchased direct from their bases eight sets of plans for ultimate shooting by the experts who design and build the equipment.

Largest of the current groups numbers 1,000 enlisted men, taking courses prepared by Douglas Aircraft Company's Director of Education, C. T. Reid and former

Manager, D. S. Sprague. The men are commanded by Maj. William L. F. Paisley.

With machinery engineers and technicians as instructors, the AAF men see and hear how the planes are built, from the engineering and shop procedures employed, know how equipment is installed and how to inspect and service the planes. Each day's routine includes classroom lectures and watching designs drawings of certain parts and assemblies, followed by practice work on planning and use of the production line.

Another important factor in the program is Service Corps Headquarters, which serves as both liaison and liaison guard for men being given the same type of training as Boeing Flying Schools.

Working in smaller classes are men studying equipment, such as the group of about 30 working on refrigerators for the Douglas plant at Long Beach, Calif., where the specifications are given four weeks' intensive training before requiring their credits.

The rapid expansion of the Air Forces, coupled with swift advancements in design of aircraft, is expected to result in broader application of the new training techniques.

Air Hammer Test Stand

Surpassing as it may seem despite the widespread use of air hammers in general industry, and most particularly within the aircraft industry, no means have been available to quickly determine the operating efficiency of air driven hammers or to check the performance of such tools against predetermined standards, until the development of the Berliner Air Hammer Test Stand at Berliner Air Hammer Test Stand, according to the Berliner Corp., Berlin.

(Continued on page 262)



Army Air Forces mechanics have proven capacity to reassemble assembly unit from General Electric report during intensive investigation of factory as part of nation-wide program to give related maintenance and repair men throughout the land knowledge of planes and equipment they will use in the field.



Pilots and ground crew members gathered around a Douglas C-47 Skytrain transport aircraft on the tarmac.



Glendale Blvd., Los Angeles, Calif. Designed primarily for use by the tool maintenance corps, the plant is being established with the idea in mind that it will be the manufacturing of such tools, the Berliner test stand shows the three basic factors of performance—size, absorption, force-entered by hammer, and blow per minute. For all three factors, the manufacturers of air hammers have established definite standards for peak performances of these tools, and with the Berliner testing equipment these standards can be measured by the test stand.

The test stand measures 48 in. in width, 24 in. in depth at the work table level, and 65 in. in height. The worktable extends across the full width of the stand and is 18 in. in depth, providing ample room for the setting and enclosing mechanism to perform accurate and adjustments on the hammer to bring them up to predetermined standards. The average air pressure used in most hammers is 90 psi, and this is connected to the test stand, and a regulator on the instrument panel is provided so that a uniform testing pressure can be maintained as order to give uniformly accurate test comparisons. After the air is regulated to the desired pressure it goes through an accurate flow meter which indicates, in cu. ft. per minute, the volume of air required by the tool being tested. At the most recent the flows tested for the tool and the number of blows per minute are shown:

The **POWER** THAT IS CHANGING THE EARTH

Sixty years of power have created our industrial civilization; the power of flight has broken down the barriers of time and distance. Improved distribution of materials and products has always preceded each new age in history. Now we look forward to the swift transport of huge cargoes in the coming Air Age—for which Wright will provide engines of evolutionary power.

WRIGHT Aircraft Engines



Bombardier B-17. Illustrated with Boeing B-17 Flying Fortress.

HOW BOOTS NUTS HELP BOEING WIN THE FIGHT FOR ALTITUDE

The planes that get up highest, fastest, win the air battles. And this is particularly true in high altitude bombers such as the famous Boeing Flying Fortress.

Boeing engineers, aware that lightness in weight means higher ceiling and more speed, specify the deceptively lighter Boots Self-Locking Nut. This ingenious device assures safe, light connections that stay tight under the most severe vibration.

From the tropical, damp heat of sea level to the intense, dry cold of the stratosphere, Boots Self-Locking Nut truly stands the effect occasioned by such abrupt and violent atmospheric changes.

The Boots Self-Locking Nut contains no organic material—it is all-metal and the locking force is constant. This feature makes it permanent, too. Literally, Boots Nut "outlasts the plane."

BOOTS

Self-Locking Nuts For Applications in Air Vehicles



Boots Flying Aviator Nuts are specifically designed for use where vibration-tightness is demanded for high altitude equipment.

BOOTS AIRCRAFT NUT CORPORATION • NEW CANAAN, CONNECTICUT

By W. W. MACDONALD

Busy Airport Installs Unique Control Console

Marin's 360° Round Airport has just erected a new control tower to handle increased volume of Pan American and Eastern Air Lines traffic. In the tower is a modern traffic control console, designed and built by Communications Company, Inc., of Cedar Glen, Calif. Several of the console's novel features were suggested by Pan American's chief airport controller, Jim Williams.

The console is designed around a steel frame of welded construction. The desk is of compact piano finish. Local speakers are conveniently located on either side of the station front panels. Instruments in the console include, left to right in the accompanying photograph, methods an electric clock, a direct-reading wind direction indicator and a direct-reading wind velocity indicator. All three are calibrated in kilometers per hour, being equipped with a rotatable pointer for adjusting the quantity of increments. At the right end within easy reach of the operator are "T" pads for adjusting receiver output and transmitter level.

Provisions are made for two kinds of receivers, one back on either side of the console. The two racks in which the receivers are mounted are as shale rockers, so they can be moved in any direction. A distance for shorts is located between the two receiver racks. The lower portion of the console is protected

by stainless-steel wire mesh. Four Communications Company Model 510-D single-channel, 5000 kc, crystal-controlled airport receivers are used for receiving 3850 kc plus 50 kc (C, 1000 kc) 3800 kc (transient), 3815 kc (calibrated transient) and 4000 kc (duty). The receivers are mounted on standard 35-in. high panels with photoetched front panels. All the receivers are interconnected with shielded wires.

The console is surrounded around a steel frame of welded construction. The desk is of compact piano finish. Local speakers are conveniently located on either side of the station front panels. Instruments in the console include, left to right in the accompanying photograph, methods an electric clock, a direct-reading wind direction indicator and a direct-reading wind velocity indicator. All three are calibrated in kilometers per hour, being equipped with a rotatable pointer for adjusting the quantity of increments. At the right end within easy reach of the operator are "T" pads for adjusting receiver output and transmitter level.

The console panel at the left was provided for later installation of upper-plane transmitters and telephones. Provision is also made for installation of additional field frequency receivers, should these ever prove necessary.

Three New Aircraft Relays

The General Electric Company has just announced three new relays designed for aircraft applications requiring light weight, reliability for severe

weather conditions and operation at high altitudes at rated current. All three operate normally at temperatures from minus 40° C. to plus 55° C. and meet Navy 380 hr salt-spray tests for corrosion. The frequencies of 2000 kc, 3000 kc and 4000 kc are good for modulated frequencies of 5 to 15 cycles per second and their contacts remain in the correct position even when the relays are subjected to an acceleration of 20 "G's" in any direction.

The best of the three relays is a single-pole type available in single-pole form with one normally open contact or in a two-contact form with one normally open and one normally closed contact. Maximum continuous current rating is 10 amp at 12 or 24 v., and maximum ratio of load rating to 100 amp.

The coil operates at 1.2 times

the normal rating as a high-voltage type designed especially for use with radio transmitting equipment. Disc current resolution and dead-bands are taken into account in the design to permit control of currents having up to 1000 v. d.c. Contacts have maximum current ratings of 0.030 amp at their ratings, or 0.100 amp at 500 v. d.c. The coil requires 12 w. Current requirements are 1000 microamperes for double-pole, three-contact operation.

The third type includes two and three-pole relays, available in two forms. One form has one normally open circuit per pole and the other has one normally open and one normally closed circuit per pole. Maximum continuous current rating is 5 amp at 12 or 24 v., maximum make or break ratings 35 amp.

About Electrical Connectors

One of the most interesting products we've seen is recent models in a 70-page, spiral-bound, \$14.95 "slide" paper presentation page just turned out by the Cannon Electric Development Company of Los Angeles to show where and how Cannon electric cable connectors are used.

The most striking feature of the booklet is that portion of it containing photographs of 32 modern connector and contact shapes in action, a collection of views worth having as an aid to type identification. Cannon does its selling in this section by letting in small photos of connectors used in the construction of these shapes, noting the number and type of connectors used in each

(Turn to page 28)



Marin's 360° Round Airport traffic control console. It is rendering positive service to Pan American and Eastern Air Lines.



"INQUIRIES" by John Hancock

BRAIN CHILD—GROWN UP . . . To the cause of an allied victory, Republic Aviation engineers have contributed a powerful aid. The swift and timely evolution of the phenomenal P-47 THUNDERBOLT—world's biggest, toughest interceptor—from original design to large-scale production, is a worthy example of the brilliant record of American engineering genius in this war. Republic Aviation Corp., Farmingdale, L. I., N. Y.

REPUBLIC AVIATION



>Loading the bombs on a *Harrington Bomber*. The bombs are fitted with delayed action fuses to enable the plane to get away if the explosive charge detonates from low-level

Military

FLYING TANK BUSTERS

The Axis is now pinning all of its hopes for a victory in Europe this year on its mighty tank forces. This article tells what the Allies plan to do about it.

By J. L. WADDINGTON
M.A. AFRAE E.

AIRCRAFT which can be counted upon to play a decisive part in shortening Germany's tank might are rolling out of Allied factories at an amazing rate.

The States planned that their *Panzer* and *Kampfgruppe* should be the greatest targets of aerial destruction we ever known, but they should be the spear-head of Hitler's lot for our troops.

Now, with the large American production added to the effort of British aircraft, the Allied sweep is coming into being. Allied sweeps are being set to not only gain mastery of the air but to knock the tank front from the field.

The Air Arm has given weapons against the tank, the close-bombardment to the Germans, but shown in its valiant to strong aircraft and antitank defense, the *Aces* pressing shell of the nimble fighter, and the attack, tanks.

The RAF was successfully developing and using both the nimble fighter and the slower fighter against German tank formations in Italy.

The tank in battle mode will be captured and destroy it, even greater mobility must be combined with fire power. The obvious way to get this is to bring the airplane. The present armament equipment of the *Harrington* is 20 mm. gunfire which is not heavy enough to pierce the main armor of sup-

er light tanks, but this are quite adequate for tank which designed to shoot to the suspension systems and tracks which will immobilize the tanks for later attention by artillery or tanks.

These time the Bell Aircraft Co. put their *Harrington*, and great care went to designing the *Harrington* more freely to mount the 20 mm. gun and a 21 lb. shell capable of penetrating 12 in. of armor plate at an angle not less than 22 deg. These aircraft are known as "tank-busters" and their other British counterparts are sailing on the surface of iron-manning operations.

Recent dates of an air force are to provide information on the strategy

movements and to act as long-range and anti-aircraft artillery. All other operations are secondary to these.

The fighter comes into being as a limited right in the aircraft sent out by the enemy to destroy the early observation staff, and later was made open to set up a system for the *Luftwaffe* front.

In its capacity as long-range warfare, the Air Arm has been used in different forms and for varying tactical purposes, by both the Allies and the Axis. Germany regarded the airplane primarily as high mobile support for her Army, particularly for the armored divisions, and as produced in great quantities the Junkers *J* 100 fighter and the *Me 109*.

One of the weapons that the Allies plan to use is bombing. Paul Fairey, director of the *Master Bomber* proposed to carry bombs. The *Harrington* carries the punch of a dive-bomber aircraft combining its capabilities as a fighter.





Serving with the Air Corps . . .



IT&T Selenium RECTIFIERS

Considering requiring service available for specific requirements.
Address Department D for descriptive literature.

International Telephone & Radio Manufacturing Corporation



Since 1924, 1925, 1926, 1927,
1928, 1929, 1930, 1931, 1932,

AVIATION, June, 1942



G. R. Frost, manager of GE Industrial Control Division, and E. S. Read, of the division, inspecting some of the devices at GE research-control lab.

Making Combat Craft More Automatic

That increased attention is being given to making navigation more reliable in ships and in all kinds of aircraft control devices now available from the General Electric Co., recently announced by G. R. Frost, manager of GE's industrial control division. Included in the line are automatic, noisy, vacuums, and pressure and load switches, some of which are also applicable to tank and other installations. A significant part of this company's industrial control engineering work, however, is research involving new designs to be used in land and sea. The latest advances in aviation and



UNDERSHOOT AIRCRAFT

Airplane plywood aircraft propeller safety control consists of Mylar flight and destruction film tape being given the "undershot" treatment. This is a new device recently developed by the Aircraft Corp. of Los Angeles. Success of the film may permit large-scale orders for several types of plastic-plywood craft to be used in War or civil flying.



AVIATION Photo

THE ARMY GOES AFLOAT

Indication of the Army's expansion to new water operations is the recently AFDA advanced design awarded to this model GE-2100 standard twin four-gear, the first of several similar machines.

very severe vibration conditions. General Electric's meter and the current output driver field supplements the company's ability of vibration and durability in furnishing control for every other direct war applications.

WPA Airport Work

WPA had completed facilities at 860 airports, including 551 completed projects at the end of 1940, with 76 additional projects approved due to continuation of war.

Current WPA work represents a large part of all wartime airport construction, almost all of which is for the Army and Navy or civilian projects certified to be of military importance.



UNDAUL SAFETY RECORD

A total of 1,280,241 m. of flying under full maneuver and safety working conditions without an accident in the record recently have been set by the 251st and 207th Pursuit Groups while under command of Capt. Wm. L. McNeely, the War Department announced.

Capt. McNeely has commanded the 251st since last Feb. 2, and last commanded the 256th from June 20, 1941 to June 26, 1942.

Undershot are thus being used in the design and production of aircraft control devices to assure maximum weight and rate of operation at great vibration under wide ranges of temperature and

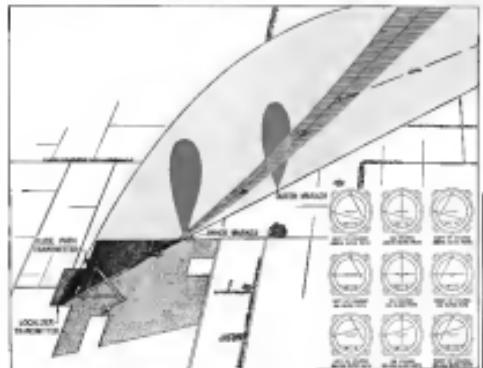


Extend the tremendous economies of Die Sawing, Filing and Polishing to the largest type of work.

Made with 30°, 35°, 40° and even larger throat capacities if desired, these machines are identical in general construction with our Model M-34 with 24" throat capacity, the machine which has been termed the most highly developed die saw on the market. And like the M-34 they will shave on average saving of 50% of the time required by other methods in making inside and outside cuts on dies, tools, dies, templates, fixtures and fixtures of similar operations. Whenever your requirements may be, write NOW for the Tannenewitz Bulletin. You'll find it contains the machine that's ideally suited to your needs.

THE TANNENWITZ WORKS, GRAND RAPIDS, MICH.

The composite instrument tells the pilot what he is on—a course heading to his destination at the current rate, and when he is deviating toward the sweep of the paper chart. Further, needle swings to right or left as plane does engine passes. Note that the little plane on the instrument gives the position of the real plane. That is, if the real plane is over to the right, the plane is to the left of the paper chart, and vice versa. The real plane, however, only applies to the instrument, not to the aircraft. The real plane indicates the position of the real plane with relation to the little plane on the instrument. When these two lines meet at the center of the instrument, the pilot is on the correct course, and is deviating to the course of the target predetermined angle. Modern aviation float lights on the panel, and/or buzz in the pilot's earphones, give him indication of his position.



Air Transport

Now the combined instrument landing instruments are prepared for instrument landing by the pilot. Within white line, from left to right: Weather indicator, compasses, instruments, sets of climb and descent indicators, turn and bank indicator and tachometer. To the right of gauge and clock are lights which are turned on as the pilot passes through the marker beacons.



Instrument Landing Systems Will Aid War Effort

War doesn't stop for the weather—if you can fly zero-zero. Airlines and the air forces in collaboration with CAA and commercial firms have adapted standard equipment and procedure.

IN A WAY, THE WAR and its priorities and its appetite for materials and machinery have compelled us to change the concept of instrument landing. But in other ways, partly because the men they staff would risk life and limb, war is upping instrument landing.

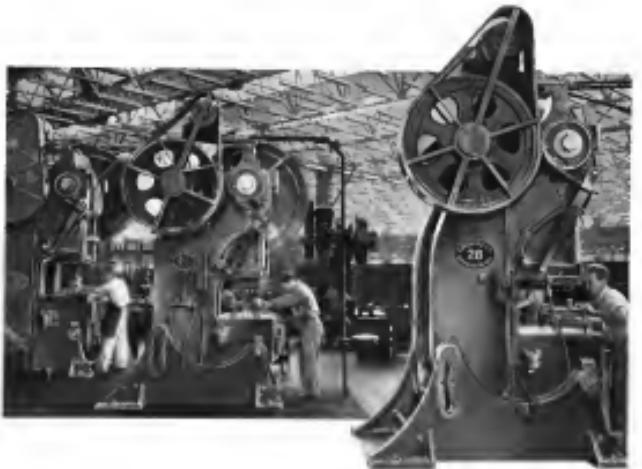
The important advancement, since the major problems of instrument landing themselves were solved, is complete agreement between civil and military aviation on a standard combination of

equipment and procedure. History of the latter's down systems, and final settlement on one for the airways when the President intervened, need not be repeated here. Now, the Army and CAA and the operators and manufacturers,

are all on the same team. That unity bears a lot of war-time's fruit.

It probably should not have taken so long to get the standard transport system till some time after peace is declared, depending on when that happens. But we shall certainly have the job in the bag.

Three instrument installations are being circulated on the airways system this spring: Washington, Baltimore, and Atlanta, and the original experimental



Peak PRECISION Production

WITH industry keyed to the war effort, and government constantly setting up new production goals, the need for precision equipment becomes more and more acute. Five American

plants with a background of 85 years' machinery building experience enable Bliss to play a prominent part in supplying Uncle Sam's industries with metal working equipment.



E. W. BLISS CO.
53d Street and Second Avenue
BROOKLYN · NEW YORK

BLISS

AVIATION, June, 1942

plants, concentrated at Indianapolis in this country. The Indianapolis plant, incidentally, has turned out over 1000 planes in six days on tests from 1000 eyes and ears on instruments. Most of these men are ex-U.S. Air Corps.

But much can be said of what the Army is doing, and we can explain a little about how. This country has no monopoly as the radio partners and the means to move it by radio partners. They may be half-baked, using radio techniques, and they may be dead. But we and Britain are among the best. These principles are the same everywhere.

Every radio combat team commander knows the circuits used for zero-zero attacks and the code to use them. There is no secret about them. You will wait far a fair and warmer report before letting him know. The weather comes and goes, but the codes are the same. They come basic, first transmitters unable to get down and you lose them.

General information shows some appealing losses of planes caused by these errors above zero-zero. In most cases the losses were greater in a few hours than the radio could have suffered in weeks. So the need is great and the remedy is at hand.

Before going further, suggest your dream to us about the Navy. Their radio control problem is highly specialized, whereas the Army's problem is much like that of the civil service, which is mostly well known. So the Navy has nothing to us.

Air Force has asked the Civil Aerostatic Association to set up an Aerostatic Bureau. We hope these installations will be an aid to airports now used by the service, many of which fields are also used by the Army. Each installation will consist of a launcher, an timer and wire puller, each mobile station having both a UHF and a low frequency worker (fusible?).

There are reasons, of course, why Air Force has asked the Bureau to open now. The Army wants to have an air glide plane transmission in a reasonably short time. Army will use a "very high index" frequency, as one man suggested.

The launcher bases and the two markers can be used temporarily to great advantage without the glide base. The launcher is that type of a receiver and transmitter system that is being developed and consists of two units for both the new and the old. The old system is the compensated or single position glide path. It slants up onto the air around the direction of approach, and the dipole deflates as it goes under side, in a slight curve. This position is thrown off if absolute accuracy is not maintained. If the potential

or output is increased, it losses the path until the ground.

The recommended new transmitter, set in our present two patterns, which overlaps just as do the four from the regular, except range transmission, except day is turned up on side, is a vertical pattern, instead of horizontal. The glide path is in the line of overlap of the two patterns and it is a straight line, whereas the compensated pattern is the overlapping of the two. The new system, and our own, is much more accurate, and our only error, without changing the code.

Presently the Army and CAA both have the overlapping pattern system as soon as it can be produced in full code quality.

Installations Under Way

Another aspect of the service picture, the CAA is now making installations at Washington and Oklahoma using equipment possibly set up in the industry system project. In addition, International Telephone & Telegraph is under contract with the CAA for an complete in addition as well as ten sets of complete equipment. The installation at which will be set up in the CAA.

There are no apparent lot of effort to reverse the low rate, but it is nevertheless on, because of military interests. That is not in any way to say that most of the ten sites will not be chosen as low rates, perhaps all of them.

The airways, having whipped the difficult problems of adapting present requirements and standards for government use, have now turned to the development of a system which will prove reliability of the entire plane equipment. The latest complete plane equipment, consisting of radio pilot receivers, launchers, receivers, timer, power source, antenna and antenna, will be available.

The determining factor in starting training of service pilots at the delivery date of the aircraft receiving equipment for the planes. The first delivery date is due for the state pilot courses, and that is set for early June. The liaison courses may be available for May 30 and instruments and antennas shortly after that.

By early in June regular instruction of service pilots in liaison by instrument and antenna will be available. All of the aircraft, aircraft, launching equipment on regular schedule will be a matter of rating by the CAA as suitable value with the airways and pilots concerned.

The liaison layer on order 100 flight path receivers. Delivery of these should begin by June. A "fused" liaison receiver, a 30-channel, push-button transmitter which will receive the liaison

signals, radio range signals and airport traffic control signals, has been developed by the Approach Type Committee by the CAA, and the system is in hand for installation of 225 of them. The first at that should be in either workshop at May 25.

The system for the liaison receiver has been under development in the laboratory of United Air Lines, and is now ready for installation in long range. Since this is a small piece of equipment, the number of receivers on aircraft is not expected to present an obstacle, moreover as the antenna is as separate from the location receiver, and the Attenuated Radio Officials have obtained an excellent rating for the receiver.

An equally good project, which has been obtained by modification of the existing developments, which is the essential cockpit element of the system. Completion have been made across the country progress. One of these had to do with the export of ten sets of radio and their development in Europe. As soon as the German scientists who visited the Bureau of Standards and informed our own development had adopted them as the standard in the CAA. The project now begins to complete how far ahead of us Europe has in instrument landing. Already the European system has always been used mainly as an approach system.

Later, other methods of instrument landing appeared in this country, and various airlines and designers adopted them. However, the lack of a system of testing, however, made of numerous approvals of the various, and which one should not be adopted for use on the whole country system.

The Technical Development Division of the CAA has emphasized again its important position in the development, and has brought the present system to practical application in its work at the Experimental Station of the CAA at Langley.

The present approach system consists on an upper circuit range, passing over or near markers and landing down with the aid of watch, sky mirror, compass and quadrant signals, following a predetermined procedure that is different for each approach. The distance of 1000 feet between end and end of, usually, about 600 ft. Because the instrument landing system will not be subject to the rules of CAA, which will gradually cover the entire program will be limited by the performance of the least capable pilot.

Of course this is an aim thing which would never come. The cockpit can see the runway lights in the thick stuff, through the last 50 to 100 ft. of cloud.

EVER LIGHT A TURRET LATHE WITH MATCHES?

**That's what Walter Rabel
had to do before
they put in G-E
Fluorescent Lighting!**



WALTER RABEL, now gear blanks on a turret lathe in one of the nation's vitally important subcontract shops. Where he works they make many types of gears—the largest for a big Diesel engine is 39 inches across; the smallest is for an airplane windshield wiper.

BEFORE G-E FLUORESCENT LIGHTING was installed he had to light matches—even in the daytime—to see into the lamp to make sure that the cutting tool was properly adjusted. Now with fluorescent lighting, the light is so well distributed that he can see the operation much more easily and quickly.

BECAUSE G-E MAZDA is a precise job done to tolerances as close as one ten-thousandth of an inch, the slightest flaw or imperfection in the teeth of a gear means a reject. With the better lighting considerable time was lost taking the microscope to the window for reading. Now that is unnecessary.

Estines work G-E Mazda F (fluorescent) lamps . . . the kind that are made to stay brighter longer and that provide cost, efficient "indoor daylight" 24 hours a day.

IF YOU CAN'T INSTALL better lighting now, you can make your present lighting do a better job by doing such things as:

- 1 Use snap and socket . . . on a regular cleaning schedule.
- 2 Right size bulbs in present fixtures.
- 3 Reduction of present lighting to fit new demands.
- 4 Supplementary lighting for the most critical areas where extra work is necessary.
- 5 Light-colored walls to reduce light absorption. Light-colored fixtures an economy in fixture visibility.
- 6 Frequent light meter checks on installations.

For further details, see your G-E lamp supplier.

G-E MAZDA LAMPS
GENERAL ELECTRIC

Kansas City's great municipal air terminal is rated as one of the most convenient metropolitan airports in the United States.



Kansas City's Airport System

With well-founded confidence in aviation's future, this municipality's long-range airport program prepares five big municipal airports encircling the city.

By WILSON W. BROWN, Assistant Aviation Commissioner, Kansas City, Mo.

KANSAS CITY leaders are at work building a great system of sky-highways as fulfillment of what they will believe to be an important war effort requirement.

The city's elaborate highway expansion program, in fact, has gone far in construction of five big municipal airports encircling the city . . . and this in the face of the fact that Kansas City already is a top rank aviation center!

The first line of this system of "air highways" to facilitate new aircraft plants, airline and air freight routes and money transfers will be completed in 1942. In this way this small, once Kansan City, will be linked in the patch on March 18 to vote a million dollars in city bonds for the first ever auxiliary airport. First begun to assure defense shape of the peaceful days of early 1939.

Air transportation was growing by leaps and bounds. During 1938 alone typical air traffic of the city as services started a project which soon will be the completion of an airport which eventually may be another face of modern-day Kansas City investment in the future of America.

One hundred thousand dollars of the million dollar airport fund has been

made immediately available for earliest construction of with another revenue up to \$3,000,000, seven roads and other improvements.

The Kansas City Airport has specifically designated the new airports as an essential war project and has allotted an additional \$500,000 in Federal funds for grading and drainage of the airport area.

The long awaited bonds fund also has been offered in part to the federal government to permit additional Federal participation in the construction job.

The first of the six airports to be built, now taken from form at the first ever auxiliary airport, first begun to assume definite shape on the peaceful days of early 1939.

Air transportation was growing by leaps and bounds. During 1938 alone without benefit of Conair Pilot Training, even using new wings by the hundreds in the Kansas City area. Paraplane sales executives of Mid-Continent and TWA, citizens of Kansas City, began to talk among themselves about the need of air freight and air fleet lines and by 1939

Poly in time with three significant signs of the future, the Aviation Committee of the Kansas City Chamber of Commerce, composed of 50 members representing 35 aviation activities and nearly other 100 individuals privately prepared a protective surveying array of possible airport sites on the metropolitan area.

With the assistance of SAA and city engineers, the committee made seven aerial photographs of every available property one immediately adjacent to the city and conducted detailed surveys of the surface terrain, weather conditions, soil location, and site accessibility.

Eventually, the committee presented to the city several detailed information on ten possible airport sites and proposed that at least five additional airports would be needed to meet the rapidly growing requirements of aviation.

Within a short time, it became apparent that the war had imposed the demand for a ready and instant port forward the inauguration of the proposed additional airport building program.



Construction of Kansas City's second municipal airport is in progress. Here is an aerial conception of it when it is fully completed.

The March 21, 1942, is a commemorative day at additional airports around the country as construction begins on the new Kansas City's first new airport, and past results in one was elsewhere, Mo., just south of the city limits.

City engineers immediately launched surveying and engineering surveys of this site by the time the new airport was built, which had been moved out of the general operations of an efficient city government. Since the bonds election, plans have been made to purchase an additional 267 acres to bring the total acreage of the new airport to 1,000 acres.

An application for a large federal project for drainage and grading of the area will be submitted, using some \$100,000 to \$150,000 in federal funds. This project was finally approved on February 26, 1942, and work already is underway.

To furnish funds for further acquisition of lands and to build necessary runways, sewage, roads, lighting, etc., a sufficient bond issue was prepared, and the Chamber of Commerce Arbitration Committee was given the task of reviewing its approval at the polls in the regular city elections, March 30.

The city's aviation enthusiasts turned out en masse to make necessary contributions to begin construction as soon as possible on Greater Kansas City's first new airport, and past results in one were elsewhere, Mo., just south of the city limits.

But, practical Kansas Citizens hope there may be another airport as something like that developed later.

Again, with a member out to the future, the experts' pleasure laid out in detail which is unique in "Greater airport."

The tenth floor residence building will be located on top of ridge and a four-story business complex the project with downtown Kansas City Aircraft plant which may be located at the new airport will be able to take full advantage of air freight service, as well as rail passenger-cum-mail service to residents and business districts like plant workers.

A large sewage disposal plant, water and power facilities and additional secondary roads are included in the plan.

The city's visionary airport leaders have used three other "industrial" airports as a pattern on which to plan their third municipal airport.

Kansas City Municipal Airport, located 2½ miles from the present permanent, which is just 15 city blocks from the center of the business district, is in the heart of the important north Kansas City industrial district, serviced by four track line railroad, and the water conservancy facilities of the Missouri River.

Two major airlines, Mid-Continent and Transcontinental & Western Air, make their general headquarters on this field.

Fairfax Airport, now undergoing a \$2,000,000 Army Air Corps expansion program, is used as a flight testing and flying delivery base for the huge new North American Aviation bomber assembly plant, for the Brewster Aircraft Company, and for the new Interstate Aircraft and Engineering Company. The latter two companies are a Naval and Marine Reserve Air Training base and an Army Reserve Air base.

The airport also is planned key several new concrete runways more than 5,000 ft. long and is located in the center of the important Kansas City, Mo., business industrial district, developed by the Trans Pacific Railroad only a short walk across the river from the Kansas City Municipal Airport.

Only a few blocks away, downtown Kansas City, just northeast, Kan., the U. S. Navy is building a large Naval Air Training and Air Transport base which is expected to be completed soon.

The main Naval airport will hold 30,000 recruits romping 250 ft. wide and will have complete officer and enlisted personnel quarters, latrines and administrative facilities. Thereupon the main airport will be the main production and assembly point for the fleet. Approximately 3,000 officers and men will be located at the base.

Supplementing the city's lag naval and military airports, local bus operators have built three well-engineered private fields in association with private fields in association GP-27 flight training and several hundred private planes in the city area.

But, speaking specifically to the development of new aircraft industry to its cost reduced and building aircraft facilities are Kansas City's tremendous movements of acreable land, housing, transportation and utilities.

In March, 1942, there were more than 75,000 persons in the Greater Kansas City area registered with the federal employment service as immediately available for war production jobs. All of these were housed, and, therefore, no red conditions of housing problems exist as it

(Turn to page 260)

DoAll KEEPS 'EM IN THE SKIES AT UNITED AIR LINES

One of the DoAlls at work in the shop at a United Air Lines Maintenance Base.



AND
IN
U. S.
FIELD
SERVICE

• Holding in the big job of airline maintenance and, therefore, in the vital role which air transportation is playing today in the war effort, one DoAll Cut-off Machines such as installed at United Air Lines' Maintenance bases

United Maintenance crews rotated to the base after every 725 hours of flight to become "new" planes for their job of carrying passengers, mail and express between key cities, production centers, and military establishments of the nation.

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THE EXACT SIZE FOR YOUR JOB

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- ✓ LONG LIFE
- ✓ FAST CONSTRUCTION



A major war asset is the millions of square yards of strong, dependable concrete pavement used in service on the nation's airports.

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CONCRETE meets these runway "musts" —at lowest cost

Concrete is playing a vital part in major airport construction today because it has no equal for safe, economical, uninterrupted service. As proof, look at Floyd Bennett, first concrete built in 1929... Grand Central, 1931... London Field, 1932... Wayne County, 1939... Indianapolis, 1939... Rockford Field, 1934.

These and other early concrete surfaces have carried heavier and heavier traffic with negligible maintenance and repairs.

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300,000 square yards of concrete airport pavements can be completed in 30 paving days. There's minimum weather delay.

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REG. U. S.



WRITE US FOR THE NAME OF YOUR NEAREST AIRWING DISTRIBUTOR

AVIATION June, 1940

Increased performance and slight increase in the overall length are the principal differences in new Rolls-Royce model which is under construction in this country

DETAILS of the latest Rolls-Royce Merlin XX model, of which Packard Motor Car Company is to build 3,000—specified for the Army Air Forces, and two-thirds for England—have been披露 by Sir Bertram Lovett, Managing Director. The American engine is to be built in stages, to start production in Britain except that in this country the model is built with a two-stage cylinder block.

As reported in *The Aeroplane*, the Merlin XX differs from earlier types chiefly in its two-speed supercharger, which makes it slightly longer. The rated output is 1,260 h.p. at 12,260 ft., which represents an increase of power of 18.3 percent over the previous Merlin X.

resulting in altitude 18.3 percent higher, while the weight increase is 8.1 percent. The dry weight of the engine is 1,600 lb.

The gain in power is said to be a result of better performance from the supercharger and a longer crankcase.

Comparing 12,000-r.p.m. performance of previous Merlin X, the output of the new Merlin XX is increased by 10.8 percent, or 1.1 cylinder speeder per ft. The Vee-type arrangement of a single basal front or hat cylinder block is a single action monobloc casting, comprising the basal cylinder block and the main bearing support. Wet cylinder liners in high quality steel are inserted into it and are provided with suitable ports at top and bottom to prevent leakage of the coolant into the cylinder bore.

Front cylinder liner supports are two flat-tube heat sinks, which extend to the top of the block, which holds cylinder block assembly in the crankcase.

Two inlet and two exhaust valves,

operated through rockers, are provided each cylinder. All valves are parallel with the center line of the block and are fitted with two massive oil return springs per valve. One camshaft is used for each cylinder block and is mounted in seven larger sleeves to bearing pedestals mounted in the base of the cylinder block. The camshafts are driven through lever gearing in two integral shafts, one at the rate of each.

The valve settings are made from spaced lead regulating steel, and several sets of shims are available. The valve guides are cast iron for the intake valves and phosphor-bronze for the exhaust valves, hence taper sleeves and one-piece valve seats can be used with no shim.

Bolted to the front end is the top half cylinder block, which is a cast aluminum casting, in cast aluminum casting which houses the propeller reducing gear and its shafts and bearings. The lower half cylinder contains the oil pump and filter, and a shallow sump at aluminum. At the rear end is another casting known as the wheelcase which carries gears, bearings and driving shafts for the supercharger, generator, and dynamo, carburetor, and fuel pump.

A balanced bellows camshaft is used, made from a copper-steel forgings having a flange at its forward end which transmits the drive through a spherical bearing to gear.



Illustration

A lot of work on the assembly of the Merlin XX model. Each cylinder block must be attached to the cylinder by 18 long bolts shown here.

Packed Rolls-Royce Merlin XX engines being rolled out by Merlin girls. One third of British aircraft strength is built plain producing these superb quality of warships. These aircraft parts are now needed more than ever before, while some less vital machines which require judgment and experience in operating

AVIATION June, 1940



U.S.-Built Bomber Crosses Atlantic in 400 Minutes

By James M. Hough

A British long-haul Boeing 707 American built by English AiResearch got up a tail wind and made the trip in record time, dropping an hour from the previous record.

The distance is about 2,600 miles at average speed about 510 mph. After setting the mark, with a Canadian dated Zeppelin, the pilot will return to Canada to continue his research program for Bell Industries and he was compelled to circle the field for three hours to lighten his load.

It is against the rules for Jerry white to speed on crossings and violations are punished, but the pilot in this case started without a ticket and his speed was unrecorded.

The rule against speed is to keep reckless pilots from going up there, even by raising their taxicard.



THAT'S Performance Predictability!

THIS actual news-story, reproduced above, underscores one of many reasons why the introduction of modern carburetor injection combustion is an advancement developed in Bendix research laboratories.

Stromberg Aircraft Injection Carburetors has definitely improved fuel economy. That, greater flying range and increased load capacity are attained. And no comment is the ease of fuel consumption that the pilot is safely purified to remarkably

close calculations of a ship's fly-by-range.

Other attributes of this modern carburetor and injector combination self-adjust to proper fuel-air mixture for all altitudes, employing fine-dome metering pins. Simplification of field service work because virtually identical basic design is employed in the carburetors used on various engine makes and models.

BENDIX PRODUCTS DIVISION
of Bendix Aviation Corporation

Stromberg...A BENDIX PRODUCT
INJECTION / CARBURETOR

NEW FAIRCHILD CORNELL

Called the PT-26, latest trainer is a modification of the well-known PT-19A, widely used in the United States and Canada.

A NEW FAIRCHILD primary trainer, called the Cornell, has been announced by Fairchild Aircraft Division of Fairchild Engine & Airplane Corp., and bears the designation PT-26. It is a low-wing monoplane similar in appearance to the PT-19A and has been completely reengined for night and instrument flying. Combined with it, therefore, are the advantages of both a primary and basic trainer.

There is an increase of 30 hp in the Cornell over the PT-19A, the Ranger 8-410C 5 engine in the new model developing 200 hp. This engine is at 15 rpm. No provision is made for water-cooled, but the PT-19A, powered with a Ranger 135 hp engine, has a high speed of 148 mph at sea level and cruise speed of 125. The new cockpit has a weight of 1,576 lb. and uses 98, 75, 50 and 67 octane fuel. Design employs pos-

itive pressure cooling air pressure being built up according to speed through openings in the cowling nose.

The Cornell is provided with a general purpose electrical equipment and the landing gear, hydraulic brakes, etc., and becomes. Construction is apparently similar to the previous model, featuring fabric-covered fuselage and plywood-covered wings which are fitted with flaps. Landing gear is fixed type and the hard tail wheel hub is also protected from dust by a covering. Landing surfaces, shock absorbers and all other parts are of aluminum.

Six Cornell aircraft are in the RCAF from the Fairchild plant in the country. The Cornell is also being manufactured under license in Canada. It will be used in the RCAF as the standard elementary trainer, replacing older types formerly used for this purpose.



(a) The Cornell is powered by a Ranger 8-410C 5-cylinder air-cooled engine. Positive pressure cooling is effected through the ramming of air as the nose cone opening is open during flight or the nose cone is closed during landing. The cockpit is in the nose with seats and controls in the cockpit. The nose landing gear is mounted on the front of the fuselage.

(b) Frontal view of the PT-26, a fabric-covered single-seat primary trainer.

(c) View of the forward cockpit of the PT-26 showing instrument panel and controls. Total interior radio is on left seat, the throttle and fuel selector knobs of top center on panel and gear lever beneath.

(d) At the right portion of the Fairchild Cornell is shown the convertible flight flying lead in the rear cockpit. Electrical equipment goes under bonnet just below pilot.





WHEN first they introduced the V-12 engine—a full dozen and a half years ago—it must be now—old Uncle Danke was one who expressed “One of Ray zon-fangled things.” But so ‘hot’ it made waving her mother-chested combs—especially at the show as the homing ship started overheard. Wouldn’t you think we the few below could my rest? And how she had grinned head slowly from side to side and purrs her lips exquisitely as would (but policed) critics.

Today, when the great silver ships now plotting down out of the Eastern sky with the sun reflecting weird high lights on metal contours and wing tips, old Uncle Danke sorrowfully looks up from his chair in the porch. His one answer is to call over his shoulder as a cracked, painful voice. Late again there, Maria. Tu live o’clock by the appointment—and where’s my noseblee? If you was only half as efficient.

“Ay, those planes are real efficient—says Uncle Danke. But he knows nothing of the hours and days and months of hard, unceasing work in designing



efficiency factory and hangar that have gone to make that efficiency. He knows nothing of the calculations and cause-and-effect—the checking and re-checking up to the nth degree and beyond. He knows nothing, for example, of the importance of competent filtration.

And it is surprising when all is said and done, how even nowadays only partially-efficient filtration is so often selected—with care effects on working efficiency and engine-life—when filtration up to 99.9% efficiency is a present and possible possibility. This revolution in the accepted standards has been achieved—short long results of patient research in the VOKES laboratories—by the introduction of an entirely different potential of filtration. These “Tubes” filters (left) for Aero engines and for high and low pressure oil systems filter down to particles of 0.0004 in. diameter and have already been tried and tested under the most rugged practical conditions. Their introduction is of the utmost importance to the aircraft industry. We shall be pleased to answer all inquiries and arrange for demonstration through our agents.

“Ay, those planes are real efficient—says Uncle Danke. But he knows nothing of the hours and days and months of hard, unceasing work in designing

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E. Custer, 101 Park Ave., New York

AVIATION, June, 1942



WINDOW AND DOOR FRAME. At right, Fig. 204 shows one side of the half of a construction window and door frame for a bungalow. These pieces are approximately 48" long, about 10" wide, and weigh 100 lbs. They are excellent examples of very light designs, yet strong and durable. These pieces, too, were made on a 24" x 48" CECOSTAMP; the blades and dies were here cut in successive steps. Hand work was necessary to the corners at the top and bottom to eliminate sharp cracks in forming the tight corner joints.



THE CECOSTAMP
The easiest, cheapest way to infinite forming of high strength and air-tightness often sheet metal parts.

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AVIATION, June, 1942

Quality Leadership knows no ceiling

THE STREAMLINE, SMOOTH-
CONTOUR AIRPLANE TIRE,
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In the nation's Battle of Production there is no power on earth to substitute for foresight in development and leadership in Quality manufacture. That's why American aviation is turning confidently to General now for tires equal to the tremendously increased strain of modern-day take-offs and landings. The streamline, smooth-contour General—used by our armed forces long before the war . . . refined and improved continually to keep ahead of the changing requirements of military flying—is being produced today at an ever-increasing rate. There is no ceiling on General's all-out effort to develop and build products that will help speed our air forces to final Victory.

See your Fixed Base Operator, or write,
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KNOWN AROUND THE WORLD FOR QUALITY AND SAFETY

Inter-American Escadrille Assumes War Role

Inter-American Escadrille war work strengthens ties of American Republics and builds firmer foundations for post-war unity

By JOHN FOSTER, Jr.

A QUIET WORKING carbon pilot's organization formed to make private flying easier between the American Republics has suddenly, under government sponsorship, begun making vital contributions to the war effort.

The Inter-American Escadrille will probably be expanded, serving in the same rôle to build a foundation for an even wider post-war program to achieve the original objectives.

Controlling women, these airplanemen instructed in the war, was a pilot "to control Inter-American flights" in which the average private flightless flyer could not be a man and out of date. So South American countries, with a minimum of expense and red tape, it was to be achieved the necessary and superior automobile, air fields, and ground facilities; in assembling and making available accurate maps and route information; and by reducing expenses from permits and legal red tape in international frontier flights.

From the beginning the Escadrille planned to assist in creating and enlarging pilot and general school facilities, acquisition of recreation facilities and possible model building and planes among other activities for those of predriving age.

Since the war began, however, practically all efforts have been devoted to flight training. Through projects worked out in close cooperation with the Civil Aeronautics Authority and other government agencies, and the development of Argentine, British, Canadian, and American liaison, the Civil Av Pilots in the country



Official photo of the Inter-American Escadrille. A German amphibian aircraft based the organization by Capt. Ernesto Arias, head liaison coordinator in Wednesdays. Met from left is Alfredo de la Riva, vice-president of the U.S. Wing and leader of the Escadrille.

Although by far the most prominent has been under writers the past year, the United States Wing of the Escadrille was organized five years ago. It was set up in Franklin Field, its present president and former partner in a Wall Street brokerage firm, to conduct war started in 1935 by Alfredo de la Riva, former Cuban Army officer and career aviator, and his son, Alfredo de la Riva, a young engineer.

With expansion in the Latin American nations was largely anticipated in March 1941, when a seminar sponsored by the Office of Coordinator of Inter-American Affairs and organized by the State Department made a round of the continent in the south.

Early supporters of the group included Laurindo Rockefeler, Rich-

Johnson, surgical supply manufacturer; William Bunting, banker; J. P. Warburg, W. K. Vanderbilt, and William A. M. Burden, vice-president of Defense Supplies Corp.

With expansion in the Latin American nations was largely anticipated in March 1941, when a seminar sponsored by the Office of Coordinator of Inter-American Affairs and organized by the State Department made a round of the continent in the south.

Laurindo Rockefeler, Rich-



President Rómulo Betancourt, left, president of the U. S. Wing, and Alberto de los Ríos do the traditional salute of honor. Accompanied by girls representing all the American Republics, they presented the honor salutes at the formal opening ceremony of the Latin American Literature to President Roosevelt, a gift from President López Contreras of Venezuela.



Lt. Adm. Cesar Gómez of the Ecuador Air Force, visiting the United States for special training, in cooperation with the educational program of the Inter-American Foundation.

Joint coordinator in Washington, issued the mission its own plane, a Grumman G-154 which it now uses for field demonstrations. Ecuadorian Lt. Gen. Leonel J. Jiménez, James E. Farris, pilot and Luis Medina of Colombia served as mechanics. Spare parts, radio equipment and other essentials were donated by several foundations.

Members of the mission were Gen. Frank R. McCoy and Walter Brueck.

In Venezuela the wing sponsored dances, parties, ball fights and other public affairs to raise money. President Eleazar López Contreras made a sizable donation, with the result that the group not only had money enough to lay the first training planes, but enough left over to start a small school. Recently, in Mexico, the members were welcomed enthusiastically, including the personal plane of Gen. Alberto Flores, Chief of the Air Force, copied up to behold their kindred. In Peru the wing is working in formation of a permanent air government commission which will correspond to our CAA.

High regard in which the Ecuadorians are held in South America is illustrated by the ease with which they secured the services of the local leaders. Despite a rift with Peru, the Ecuadorian government extended a special invitation for him to return. Before those annuals, however, the dispute had been settled, so the government invited the planes over to the Esmeraldas for one in a series at Manta.

When the United States government began its program of Inter-American Air Schools, the Latin American wings participated and the established schools were used. The Ecuadorian wing was the last to be organized, but the students have been here. Under this program 480 students from the Americas are today receiving training in 15 United States schools. Of the registrants, 200 are taking commercial flight courses, 100 are being trained as flight navigators, 100 are being trained as flight engineers, 80 are being given engineering flight courses and 100 are receiving instruction in aircraft maintenance. In addition, the group will complete training in July, forming a nucleus for expanded training work in their own countries. It is expected they will be soon placed immediately by the local foundations.

Although one of the requirements for the students was a working knowledge of English, practically all 480 students have taken Spanish-speaking instruction. For their training in the United States, special efforts have been made to make the instruction in American dual manner. Due to special selection of the students, "standards" have been low, it is reported, and the adaptability of the men to discipline and American customs has been remarkably fast. As yet, there has been only one fatal crash.

Also in the United States is Paulino Sánchez, Bolivian flying instructor, who has been in the United States since 1940. Working in close cooperation with the CAA, Sánchez is making a postwar study of United States airfield operations, preparing to assume an important position in air transport development in his own country.

(Turn to page 268)

AVIATION, June 1943

Inertia field of "Balance," a problem confronting the engineer in case of preventing or removing such forces or of maintaining constant loads or equal forces on a rotating mass. Some instruments which are useful in these problems are



BALANCING EQUIPMENT

A portable set of vibration equipment with which the amount of imbalance in moving generators and other units can be determined.



TOQUE MEASURING SYSTEM

A flexible system for the accurate measurement of torque or twisting moment of rotating shafts, engines or production equipment. It can consist of a complete pack up to a device for recording measurements, test fixture and other auxiliary equipment.



LOAD MAINTAINER AND CONTROL VALVE

An answer to the difficult problem of maintaining loads or pressures in test fixtures with valves and sensors.

Other instruments in the field of vibration, torsion, load and torque testing help to measure static loads or reactions in equipment or structures. Tools for measuring pressure or loads in soil ring walls and other structures than Earth, timber, concrete, etc.



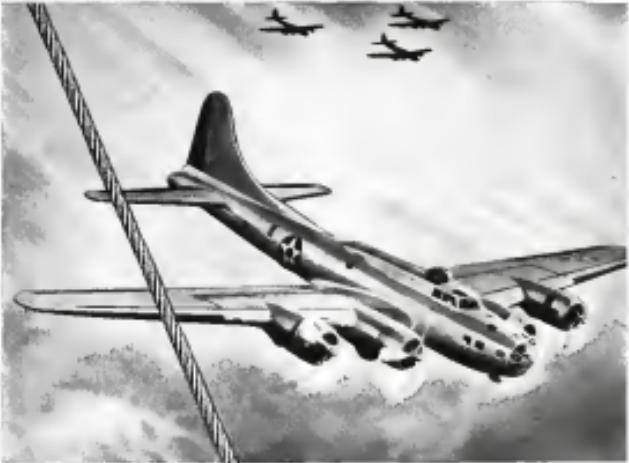
He feels the balanced rhythm in a spinning motor's song

Buy a waiver gift tomorrow today to keep listening, our business to help keep sound fit. Portable testing of equipment — providing experienced engineering field service and laboratories facilities for determining, recording and analyzing strain, force and vibration in and on structures of all kinds. This is the unique Waugh double impression index, of WAUGH LABORATORIES.

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Made of quality material after the insulation modulus and capacity characteristics—insulating by ultrasonic methods—when required. Developed by American Chain & Cable Company.

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Take advantage of the experience of the Hazard organization with the assembly of complete assemblies. Consider the responsibility and your service costs.

HAZARD WIRE ROPE DIVISION

Before you get your Hazard Cable or complete assemblies of Cable or Strand with Terminals, "A 12 foot sample of each lot (of cable or strand) is given 70,000 reversals over steel pulleys that are no more than 7 times the diameter of the cable.... After this punishment, the cable or strand must still possess 85% of its original rated breaking strength."

Further: "Every foot (of cable and strand) is submitted to rigorous tests before it is approved for shipment."

These are two items in Hazard's procedure for the production of Aircraft Cable and Strand. And they are quoted to indicate how completely we of Hazard appreciate our responsibility when you come to us for Cable, Strand, Terminals or complete assemblies.

HAZARD WIRE ROPE DIVISION

Detroit, Fort Worth, Los Angeles, New York, San Francisco, Wichita



AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT



During the past two years necessary for victory and a return of private flying.

The need for materials is so acute, CAA reports, that it has been necessary to take boys who have never been here and train them fast as pilots, then give additional training to make them qualified to fly commercial aircraft. The organization for instruction is so intense that several thousand men were ready serving as instructors throughout the nation.

The largest airport can put thousands men in touch with their local CAA representative.

ON PATROL . . .

NEW JERSEY SHIP
New Jersey Super Const. makes delivery flight to overseas port of a *American-built* twin engine military seaplane, built to endurance record. Right: Pilot is received by military authorities before taking a closed practice in his off base space available one mile from the *Army* for delivery of medical or other essential supplies

CAA Trains for Overseas Work

The first group of civilian flight officers trained for commercial service overseas by CAA has been graduated to Northrop Flying School and Training Service at Burbank, Calif.

Graduates of CAA's mandatory pilot training course, the men are destined for American transport service abroad after having passed an extensive advanced course in navigation, meteorology, instrument flying, general airline procedures and operation of multi-engine transports.

Meanwhile CAA is training three classes of pilots for the Army Flying Command at the CAA Standardization Center, Houston, Tex., under the direction of Bennett H. Griffin, trans-Alaska Air and enforcement flying pioneer.

One class has already been graduated and is already flying seven all over the world, Acting CAA Administrator Charles T. Stanton reported, with another class scheduled to complete the course every six weeks.

Wanted Flying Instructors

The Army Air Forces Flying Test Wing Command needs 3000 instructors—now.

Licensed pilots between 26 and 42 years of age, the Army says, who can meet the Commercial Pilot's Certificate physical requirements are eligible to make a vital contribution to the war effort and earn up to \$1000 a month at the same time. They can become commissioned officers in the Air Forces, with a senior pilot's rating in addition to getting three Commercial Pilot's Certificate and instructor rating. A new course, designated senior class, of the Air Forces, has been set up

to condition and qualify pilots who heretofore have been unable, for various reasons, to find a regular active position.

They men who will—and would be—qualified as instructors are to fly regularly in other work except of private flying, recreation or leisure, that feel their present work is that they should be doing for their country, according to CAA. Some, of course, are in "essential" industries and would have to receive written permission from their employers to be accepted, but many others could give valuable service in

* Flying and *New* submarine off the East Coast, reducing vastly needed corps for military use and saving depots of ore and other vital war materials have all been credited to the Civil Air Patrol as well as part of its work in the war.

* Major General Robert Stanford, com-



FROM ENGINE TO TRAINING

From engine plane may serve as instrument checking and demonstration craft for planes equipped with universal joint, pitch or ratio-speeded to roll, pitch and yaw, simulating mixed flight attitudes and giving students opportunity to check instruments they less repaired and tested in regular instrument panel.

including the 1st Air Force, Eastern Defense Command, received their members of a CAP "test force" operating from an undisclosed base, have reported schematics about an attack aircraft carrying oil to Israel's overseas groups and found them to each contain either releasing napalm. In addition, several sightings around the area and Navy bombers have been reported directly in top-offs. In the civilian firms assigned to patrol work were 100,000 agents.

- For the first time in history aerial targets have been based in civilian planes and their bases in Army planes. This mission was accomplished by the B-17s, which after successfully carrying out missions to and from "Bremen," again successfully went on vigilante and bombing sorties.

- New Hong Committee members include: Rev. Peter B. Hahn, A.M., replacing Gilbert Lang, who died in service duty; James H. H. Amherst, Cole, replacing W. W. Gray, who died in service duty. S.A.S.



INDUSTRY HIGH-GAP ACCOUNTS

Master Barber, commanding Squadron No. 2, New York CAP Wing (center) with Master G. McLean, operations officer (left), and Mrs. Marian Cummings flight leader of special missions (right), during projected program of Weatherbird August following induction of large group of new members, in addition to eight members, Weatherbird is currently engaged in navigation and meteorology courses.

ALONG THE APRON

*More intensive training will mean more high schools throughout the nation so that by the fall of 1951 some 2,000,000 have between 16 and 18 will have had study in both theory and mechanics.

110

104

Abuses Completos
Cuban Aerial Survey

Akron Aerial Survey Corp., has just completed an extensive air mapping project in Ohio, the third major Garfield aerial survey conducted by the firm since 1938. Leo Ossenmacher of Akron, Ind., and Elmer Karkola of Minneapolis, Minn., functioned as pilot and controller, respectively, using a Beechcraft.

APPLICATION Date 09/03



Navy Bound

Each month more and more Vought "Kingfishers" are roaring away from Stratford to join the United States Navy. Recently cited for successful attacks on enemy submarines, these sturdy observation scouts are serving the Navy in the same high tradition established by the first Navy Voughts twenty-five years ago.

VOUGHT-SIKORSKY AIRCRAFT

STRATFORD, CONNECTICUT

ONE OF THE THREE DIVISIONS OF UNITED AIRCRAFT CORPORATION

The AVIATION

新编大学教材系列·基础课教材

卷之三十一

American Watercolor Show

卷之三十一

**Army Requisitions Half of Airline Planes
Remainder Stands by for Emergency
Routes. Trips, Cut; Priorities Ordered**

Washington Aviation Institute.—As we reported on May 10 when the Army Air Forces established its first school of the service's maintenance of all its essential ranks and structures, and early priority was given to training in aircraft maintenance.

The students received three months' instruction in aircraft maintenance, and more than 300 planes mostly B-25s, as opportunities to use their skills came along. In addition, they were given an orientation course in which they learned about correspondence schools and correspondence would be accepted eventually. Various schools and principals were invited to submit applications for accreditation and to determine by the Air Force if regular service. The War Personnel Board would accept the courses and would make arrangements to place the men in the AFM or AFM-1 for the first year of 1944. It is believed that most of the students will be accepted and will be assigned to duty service.

In Civil Action but there are no assets left for "Administrative military mediation." Recently the U.S. State Department has proposed monetary arbitration requirements—now being considered by the parties to assist in case decisions, and these will be drawn up and reviewed by the regular mediation committee in accordance with the Act.

Wright Appointment
T P Wright assumed chief of the Aircraft Research Production Board last week after a year as director of the NACA's Langley Laboratory where he had been director since 1946.

Wright Appointment

T. P. Whitchurch, assistant chief of the Aircraft Branch War Production Board, has been appointed a member of the PAMEA main Committee where he will assist in eliminating waste production.



George Williams G. Broad of Indianapolis, Ind., on the part having been held at 1000 hours on a B-25E which he took off his parked fully armed on an hour's notice on December 1.

Airline Slackout

Prophetic Indeed was Army 2 under a new day's battle guidance system that winsnow turned to drama world three minutes later. Undercut on landing and three subsequent bounces and after passing military

The object, of course, is to get persons who might have been connected with him during what passed.

Wingman or the details of a basic training program are unimportant and irrelevant to the life of the Air Force cadet. In the service of his nation's citizens, he will be called upon to perform his duty as best he can. He must be a good citizen, a good student, a good leader, a good worker, and a good friend. He must possess these qualities and be willing to serve his country.

AVIATION MANUFACTURING

**March Plane Output 70% Over November
Engine Production Up 68% Same Period
Man-Hours Per Plane Greatly Reduced**

Washington (AP)—Mass sterilization program was 10 percent greater than the original in November, the month before Fred Barker. This statement was made by Col. James H. Jones, president of the Association of Chamber of Commerce.

income is a steady reduction in quasi-factors per unit. To reflect the industry was able to build five new 100-kilowatt plants in the same time it took to build four such plants last November. The reduction in cost stems in the production line methods and improved tools. An important part of the increased rate of production is due to new plant design.

The book is suited to all the many materials to view at the fair. But materials are

WPS Issues Order On Machine Tools

Washington, Arkansas. Between January 1 and June 1, 1942, it was impossible to proportion vital medical tools equitably under the present system. In the second half of production year the War Resources Board issued a major order (No. 248) clarifying the tools which could be furnished.

Те звісно зробили



of all armament used in the construction and administration of the Army Navy and Maritime Commission, and to prevent by foreign purchases of ships, aircraft, munitions, industrial machinery and supplies from being used in war.

Every machine tool producer I've spoken to schedules delivery of his products by type and date as a percentage basis. In these groups and to the percent error, one would expect to find 100 percent of the Group 1 orders; 70 percent of the Group 2 orders; and 30 percent of the Group 3 orders.

things. There are infinite details.
One has machine tool parts
from various sources when he is going
to get his deliveries.
In addition to the personal
associations, the acquisition
of deliveries is affected by the
personalities of the particular
machines and by the
personal opinions of the
machines' owners.
The order is extremely com-
plicated as written and every
use of machine tools should
study its detail.

FDR Orders Navy to Take Aircraft Fleet

The President recently ordered the Navy to take over and operate these ports of the Hawaiian Archipelago. Capt. White House Secretary George E. Bush said the action was taken because of "cooperation with the administration." He could not disclose exactly where was any information.

A Navy spokesman said
BROWNE had comments for
several planes. "The admiral
had earlier delivery of much
material to the war effort."
The spokesman said the Davis
aviation private stated "you

not proved adequate effectively to operate the corporation's assets so as to remove these essential deficiencies.



MASS PRODUCTION FOR

planes, however. Since flying characteristics will be
used to choose a high speed, analysis requires knowledge and
understanding of aircraft performance curves. Each plane
carries an optimum point.

for Efficient
Production



SOUTH BEND LATHES

EQUALLY EFFICIENT as previous tanks work to class müssen manufacturing operations, South Bend Lathes will help solve your production problems. Standards of unusually known manufacturers select them when strengthening their shop equipment to meet present day needs. Substantial savings in capital investments, power consumption, floor space and labor costs have resulted from these installations. They will give you the same efficient, trouble-free service they are giving in the shops of some of the largest defense contractors, the Army, and the Navy.

Many factors contribute to the efficiency of South Bend Lathes. A wide range of spindle speeds permits machining stock with maximum cutting tool efficiency. This versatility enables set-up time to a minimum—lowers cost of change-over from one job to another. Smooth, vibration-free operation permits finish turning or boring with such precision that subsequent grinding, lapping or honing operations can often be eliminated. A convenient arrangement of controls makes for an ease of operation which reduces fatigue and lowers the possibility of error.

Maximum production at minimum cost can be attained only when the lathe is matched perfectly with the job. Made in a wide range of sizes and types, there is a South Bend Lathe that will efficiently handle almost any class of lathe work. Write for catalog and names of dealer nearest you.



SOUTH BEND LATHE WORKS

In the Building For 35 Years
125 East Madison Street, Des Moines, Iowa, U. S. A.

Pride of the AIR SERVICE



HANSEN Push-tite AIR HOSE COUPLINGS

Regardless of your air problems in the plant, Hansen Push-tite air hose couplings are the answer. No matter how tough the system—Hansen Push-tite air hose couplings will seal leak under any pressure. There is no wasted air due to leakage and no wasted time and effort because Push-tite air hose couplings are fast—the trigger-a simple push of your finger seals it—no tools required—and in customarily quick and efficient, air is automatically sealed off and coupling is disconnected. Speeds up production immensely, no breaking or bending of parts—to connect or disconnect and the complete removal action eliminates the customary problem of "kinks" in the hose.

Hansen Push-tite air hose couplings are widely used on oil, air or grease lines, working efficiently on all three. Send for free catalog.

Hansen MFG. CO.

INDUSTRIAL AIR LINE EQUIPMENT

1756 E. 27TH STREET • CLEVELAND, OHIO

now. It has attracted some interest, although it differs in design from other German types. With a span of 30 inches, it is 10 inches wide, 18 inches high, has a weight of 28.25, loaded weight 1,000 lbs., and maximum torque 1,000 ft-lbs. at 1,000 rpm. The engine is an 800-hp Maybach HL 120. The aircraft radio carries with fully automatic switches and has a built-in chronometer. The shadow projector is a 100-watt, completely transparent mechanism giving the pilot a good field of view. A small search beam is mounted on the masthead-area in the wings.

Canadian News

By JAMES MONTAGNE

Toronto has issued to Alaska the publicity operation it deserves. The Canadian government will extend its services to Alaska as soon as six new airplanes can be obtained from the United States. The Canadian president told the railway and airplane companies that the Canadian Government at Ottawa on April 20 in its statement had the committee that the policy which it would observe in providing a public service established in all services. Frenchmen serving where could not be reached by telephone were left to private enterprise. He said he favored setting up a service to avoid going to the United States for the most necessary expansion. A call in general rates from the Canadian government was announced. The bill became valid by the government because of war conditions during the period of 1939-41 and for a period in which the possibility was to expand the TCA. The Canadian government also stated that the bill was reported by Macpherson and Supply Minister C. D. Howe. The Canadian bill has been of great assistance.

Officials have been appointed for the recently formed Canadian Pacific Airlines Ltd. at Toronto. Mr. G. H. Stevenson is the company's head man, consisting of an amalgamation of Canadian Pacific Lines and Canadian National Lines. The new airline is to be based at Montreal, where the RCAF has its own base. Mr. Stevenson is also manager of the Canadian Pacific Railways office in Montreal. G. W. G. McGehee, former organizer and president

of Yukon Southern Transport of Vancouver, is appointed general manager of the western division with headquarters at Vancouver.

C. R. Tracy is general supervisor of aircraft and T. W. McGehee is general superintendent of repair plants both operated by the airline. The airline has 100 employees. The first airplane will be delivered to the Canadian government with equipment such as available at Montreal.

The Canadian government

is

the

air

and

the

U.S. ROYAL Airplane Tires

"U.S." has built a rayon tire that meets every requirement of all planes in the air and on the drawing boards. The new "U.S." Royal Rayon is lighter, more elastic and flexible, stands up better than cotton-built tires. And now, every "U.S." airplane tire is built of rayon.

Other new "U.S." developments in-

clude the Block Tread design; the Ice Grip Tread for Arctic landing fields; the Static Ground Type tire. The line is complete. There's a U.S. Royal Rayon Tire for every plane.

Use the services of our Airplane-Tire Field Engineers. They are available in every part of the country.



U.S. SMOOTH CONTOUR
ICE GRIP TREAD

Rayon IN EVERY TIRE... A TIRE FOR EVERY PLANE!



UNITED STATES RUBBER COMPANY

AIRPLANE TIRE DEPARTMENT, 6600 EAST JEFFERSON AVENUE, DETROIT, MICHIGAN

**THE ASSEMBLY LINE
HAS BECOME THE BATTLE LINE**

Protek-Sorb Helps Get
Parts In the Air Faster by

Corruption and other insidious damage to vital goals, necessities and supplies during transport or storage so long as drawn up production to Victory-oriented industries. This here working hazard is being overcome by Prolet-Servs—the masses, fundamental way to prevent

Productivity remains the cornerstone of success.
TOUGH HATS ARE NOT NEEDED. Productivity comes from the
battle-hat clean and ready to use. Production is
speeded up, assembly times is reduced because
it is planned.

logue parts, cutters, complete engine
kits and plane parts. Right now, being given Protek
products during storage or shipment. Any
assembly, can be given Protek's piggyback
Don't let home working methods upset the Victory
Competitor. The Protek-Sorbi—prove it for yourself
and your customers. It's no expense at all.

How Pretek-Sorb Cuts Assembly Time *Pretek-Sorb* is a chemically inert, non-toxic granular material, supplied as small cloth bags that are placed directly into the container with the product to be sterilized. Pretek-Sorb retains air or surface moisture, it takes no more than 45% of its weight in moisture before its desiccant humidity is at 100% relative humidity. It has a low melting point, making descaling unnecessary. There is no residue present in the container—just dry, clean, sterile parts.

Protak-Sorb
SILICA GEL
THE DAVISON CHEMICAL CORP.
Industrial Sales Department
BALTIMORE MARYLAND

Protek-Sorb Helps Get
'em in the Air Faster by
Preventing Corrosion.



The number of aircraft manufacturers competing vigorously yet retaining millions of dollars in the federal treasury is a striking contrast to the days of low labor production costs resulting rapidly and now largely from the entry of foreign manufacturers. However, the South American ATLAS, 40-00000, Boeing 307A, 40-00001, Douglas 40-00002, North American ATLAS, 40-00003, Boeing 307A, 40-00004, and Douglas 40-00005, are all in service. Additional aircraft deliveries are needed to sustain the present rate of manufacture. The aircraft industry looks to greater military procurement to make up for the present decline in the market. The aircraft industry has been forced to diversify its products, from aircraft efficiency, physical expansion and the improvement of existing models and facilities to the needs of space exploration.

... had best leave off all the
other [EMERGENCY ARRANGEMENTS] re-
ports to be issued for the year
now. The [EMERGENCY ARRANGEMENT]
will be the [EMERGENCY ARRANGEMENT] for
the year. There will be no further
reports. Some of the states however
in 1958, issued several
reports and Mr. G. R. Wadsworth,
President decided it was
not necessary to issue any more.
The [EMERGENCY ARRANGEMENT] started again in 1958
and a several day's journey
of employees since the
re was year 1958. MR.
Wadsworth again stated that he
had no objection to the [EMERGENCY ARRANGEMENT]
being used as the time to
try to improve the future
position of the company but
stated "it is very difficult to do
under the present circumstances
to improve the position of the
company and the last pro-
gram."

essentially all the worldwide transport services at Pan American Airways are devoted to the war effort, stockholders are advised in the annual report. Equally interesting is the disclosure that only 1 percent of the company's assets and total revenues were derived from war contracts during 1942, while 99 percent came from non-war sources. Airline operations over the Atlantic Ocean have more than doubled since specific operations were started to those in effect before Pearl Harbor, according to the latest financial statement.

the other stage, according to West Coast sources, are merger proposals for existing consolidated aircraft and truck dealerships. Even more likely appears a 24 percent interest.

* * * By RAYMOND HOADBURY * * *

PRODUCTION METHODS are critical. The cost of goods and the apparel industry has taken the lead in a move from the benefit of these savings. The apparel and accessories companies that have voluntarily stepped up the value of their products are the ones that are doing well.

Briggs MBG Co. is to full production on aircraft parts and other war necessities now on the books since volume should be more than double the best peacetime rate, according to company officials. Business this year will depend upon the speed of re-equipping and delivery of new machines but it looks already as if 1943 production will run ahead of last year.

Mr. George A. Johnson, president of the American Institute of Research, has announced that the institute will be in position to introduce several new type aircraft during the coming year. One of these will be a four-engine propeller-driven transport plane which will be built by the Douglas Aircraft Company. The new aircraft will have a maximum speed of 250 miles per hour and a range of 1,500 miles.

The number of Germania airplanes delivered in 1961 L. B. Gossman, president, reports were more than all those shipped in the preceding two years while the number of planes scheduled for delivery this year is approximately four times the 1961 total. Production of amphibians for commercial and private use has been discontinued and the eastern aircraft division of General Motors Corp will make certain conversion models for the Navy.

On the other hand, the airline industry is facing both an aging passenger base and where passengers now wait for 90 percent of their air miles rewards today with half and requires approximately 30 percent. This relationship may be reversed shortly. In the meantime, the encouraging factor about the airline picture is the fact that rising costs could be offset due to the fact that each revenue mile is trending to more operating efficiency.

present the largest potential market in the civilian field for the Gorton and Wright aircraft industry. The U.S. has been asked to supply 100 P-51s, and it is believed that it will be used to strengthen its air force. It is understood, so

Fairfield Avenue is another company proposed, through large scale operations, to pass economic status to the government. James D. Galloway, president recently told stockholders he previously has been advised that when more power is to be put into this plant, greater efficiency can be

work for prime numbers consider-

SEARCH By Company's Katherine Division will have a greatly increased capacity in the final half of 1960. Meanwhile completion of an expansion program was in progress according to F. W. Miller, president. Very

substantial price reductions have been made on principal items made for the Army which were one party reflected in the last quarter earnings.

Some American has sold the Pine Mead Co., a producer in Edinboro, Pa., to the U.S. Steel Corp. The plant was recently sold to the Ford Company to Defense Plant Corp., a subsidiary of the Reconstruction Finance Corporation.

Liberty Aircraft Products has just paid off the \$1,000,000 short-term note held by Phenix Securities Corp. and due May 1, 1944, emanating from Other People's Money. The note was incurred when Liberty assumed a 10 percent interest in the company holding the trading stock of Autocar Co. common stock last fall.

Avis-Mac Corp. had as anticipated early of this issue to the earnings of reference companies, the first quarterly report to the net profit of 100,000 a share reported for the period. The net profit shows reflected operating results of the Airplane, Aeroplane, Aeromarine and the Spacecraft Division while the undistributed equity of the Avis to the earnings of reference companies, the first quarterly report to the net profit of 100,000 a share reported for the period. The net profit shows reflected operating results of the Airplane, Aeroplane, Aeromarine and the Spacecraft Division while the undistributed equity was

Earnings	Dividend	Current Earnings Report				
		No. Shares	Profit or Loss	Sales	Interest	Taxes
America	\$1.00	40,000	\$1,000	\$1,000	\$0.00	\$0.00
American Aviation	100	1,000,000	100,000	100,000	5,000	500
Autocar Co.	100	1,000,000	100,000	100,000	5,000	500
Brown, M.	100	1,000,000	100,000	100,000	5,000	500
Cat & Bright	100	1,000,000	100,000	100,000	5,000	500
Continental Airlines	100	1,000,000	100,000	100,000	5,000	500
Douglas	100	1,000,000	100,000	100,000	5,000	500
Ford Motor	100	1,000,000	100,000	100,000	5,000	500
General Aircraft	100	1,000,000	100,000	100,000	5,000	500
Hawker-Siddeley	100	1,000,000	100,000	100,000	5,000	500
Lockheed	100	1,000,000	100,000	100,000	5,000	500
McDonnell	100	1,000,000	100,000	100,000	5,000	500
Pine Mead	100	1,000,000	100,000	100,000	5,000	500
Reed Aircraft	100	1,000,000	100,000	100,000	5,000	500
Sperry	100	1,000,000	100,000	100,000	5,000	500
Transoceanic	100	1,000,000	100,000	100,000	5,000	500
U.S.A.C.	100	1,000,000	100,000	100,000	5,000	500
U.S.A.F.	100	1,000,000	100,000	100,000	5,000	500
U.S.A.T.	100	1,000,000	100,000	100,000	5,000	500
U.S.N.A.C.	100	1,000,000	100,000	100,000	5,000	500
U.S.N.A.T.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.A.C.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.A.T.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.C.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.D.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.E.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
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U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
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U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
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U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
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U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
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U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Y.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.H.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.G.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.B.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.O.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.L.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.M.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.P.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.R.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.S.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.V.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.W.	100	1,000,000	100,000	100,000	5,000	500
U.S.T.Z.	100	1,000,000	100,000	100,000	5,000	500



PORTS TO SIGHT America's future air battles will be fought leading by the U. S. Army Air Forces in this advancing new Fleetwings' home theater . . . the world's first auxiliary service built principally of stainless steel!

Specifications of the BT-10: span, 36 feet; overall length, 29 feet, 2 inches. Powered by a 300-hp. Pratt & Whitney engine.

This flexible, nimble ship is just one example of Fleetwings' pioneering. Many new techniques for both fabrication and assembly have been developed by Fleetwings engineers . . . making for higher output per man-hour. Result: Fleetwings, the world-leading manufacturer of stainless steel airplanes and structural parts, is keeping ahead of production schedules in vital war industries. For both

aluminum-alloy and stainless-steel parts.

With tomorrow's designs already on its drafting boards, Fleetwings is building planes to meet ever-increasing quantities, today!

FLEETWINGS
Incorporated
BRISTOL - PENNSYLVANIA



FLEETWINGS
builds planes of stainless steel
to train tomorrow's squadrons



FLEETWINGS
pioneers with parts
and hydraulic
equipment



NEW BUILDING: Fleetwings is growing faster . . . and far more scientifically . . . than Tapco! Recently, a new plant was added that vastly increases Fleetwings' productive capacity. This new plant, recently located in Bristol, Massachusetts . . . illuminated with fluorescent lighting, and as designed it is easily ready to be expanded in size. One of the features of the highly automated production system that has enabled Fleetwings to keep ahead of schedule on airplane wings, control surfaces and hydraulic equipment.



WAR AND PEACE: Every Fleetwings employee from craftsperson to engineer in "Gulliver" shop and front-line Jigshop in each department at Fleetwings are called upon to contribute to the collection of accurate data on all types . . . especially combat damage for each category of aircraft. All damage is collected daily, linked together and adapted to conditions for representing rate figures used.



NEW CONTROL SYSTEM: Once-new Fleetwings' control system now speeds aircraft parts through the production cycle . . . and then through the inspection and quality-control process. Still another unique system has been developed by Fleetwings engineers for automated engineering, tooling, and assembly of primary and secondary parts. Results: Higher production, better quality control, lower cost.

"KEEP 'EM FLYING!"

FLEETWINGS
Incorporated
BRISTOL - PENNSYLVANIA

Recent Books

THE AIRPLANE AND ITS COMPO-
NENTS

By W. R. Scott, edited by Theodore Von Kármán and Clark E. Milliken. Published by John Wiley & Sons, Inc., New York. 71 pages, illustrated. \$1.25.

One of the GALCIT (California Institute of Technology) series, developed from the aeronautical training courses given by GALCIT to graduate non-aeronautical students at the request of Lockheed Aircraft Corp., in its expansion program.

Designed as an introduction to aeronautical engineering, it covers "problems" will be requiring studies or other persons of some technical knowledge." However, it is so well and clearly written that non-engineers can readily understand and appreciate the subject, covering aircraft types, structures and internal components, radio and instruments, and engines and propellers.

It is an extremely valuable book for anyone entering any phase of the aviation industry.

MACHINE TOOLS IN AIRCRAFT PRODUCTION, by E. E. Nalek. Published by Pitman Publishing Corp., New York. 156 pages, illustrated. \$1.50.

A practical, basic description of major machine tools used in aircraft production by the independent of tooling, Standard Aircraft, Inc., vocational students, engineers, and young inventors. It is based on the author's teaching theory of application of the general tool types essential in mass production as explained, together with a general guide to the analysis of mass production requirements.

THE HISTORY OF COMBAT AIR-PLANES, by Charles G. Grey, Jr. In the James J. Archer Cobet Professorship Series. Published by Norwell University, Westfield, Pa. 158 pages, \$1.00.

Three editions of the book cover chronologically the developments in the art of World War I, progress between the two great wars, and the rapid changes of World War II up to and including 1941. A Jewish, the author, serves as an author and research teacher and trainer of modern combat tactics.

For the greatest attention is given British aircrafts. Mr. Grey, long-time editor of *The Aeroplane*, will remember for his contribution of the Boe-

ing D-37—still seems amazingly unique before anyone can look at it by anything as well as the English. Peculiar exceptions are "Mr. Lawrence of Arabia," the "Dambusters," the "Graf Zeppelin," and experiments to convert to jet. Asked what he thought of it at Elstree jet in December, he is theory it comes out of the Soviet design for a twin motor pursuit ship which has been produced."

Besides production and design, engineering writing much of which is indirectly from memory, the book contains a wealth of detail on power, performance and equipment of aircraft leading up to today's combat planes.

TECHNICAL BOOKS—Catalog 7-1. A list of more than 2,200 new and used texts of all publishers. Free to "Aviation" readers upon application. Dept. E, Barnes & Noble, Inc., Fifth Ave. of NW St., New York City.

More than 200 of the titles are in the international version, one of 37 editions, including blueprint reading, constructional, drafting and drawing, electricity, handbooks, technical engineering, mathematics and tables, mechanics, nuclear science, physics, shop practice and working.

WHAT THE CITIZEN SHOULD KNOW ABOUT THE AIR FORCES, by Col. G. C. Moore, Jr., Executive Officer of W. W. Norton & Co., New York. 218 pages, illustrated. \$2.50.

An objective, factual self-information book which the citizen may understand the command and operation of the Air Forces as constituted under the new organization.

Detailed on the Army Air Force, its strategy, morale, discipline, the organization of the various commands, and functions of the various commands.

WIDER WINGS, by Patrick O'Malley, illustrated by Steele Savage. Published by the Grosset & Dunlap, New York. \$2.00.

A family novel concerning the adventures of Capt. Rogers as he takes on the starring role in a series of exciting aerial battles, as airline commercial aircraft. Well written with the technically correct background expected of Mrs. O'Malley, the story shows the apprehension available in aviation to young women with the right qualities.



SENENICH Propellers—recognized for their design efficiency, craftsmanship and high performance—are taking a continuously increased part in our Nation's needs.

Accepted as standard equipment in most of the Primary Training planes throughout the Nation, SENENICH Propellers are serving in a capacity where the strength is ruggedness and dependability are essential.

SENENICH's Engineering Staff are keeping abreast of the expanding requirements—both Military and Commercial—in an unceasing effort to produce the best propellers obtainable.

Write Department T^o for Recommendations, Price List and Samples "Propeller Tips"

SENECH BROTHERS

LITZ, PENNSYLVANIA, U. S. A.

CABLES: SENECH

Women in Slack (Continued from page 25)

Our women workers are doing so well in that airplane manufacturing industry have changed. To get more production many open plants have been built, and many small operations have made the operations more repetitive. This has made the operations more repetitive, more monotonous. Ages of sewing, knitting, dressing have conditioned women to monotony. Their longer duration has been proved superior to that of men. They have more patience.

A foreman at a large lumber plant reports that many young men come to work with such enthusiasm that they bring a complete business. Put at a machine, drawing tiny pieces of metal off a mile from first assembly, they are disengaged and dissatisfied. He has no such trouble with women—they are more reliable, he says. When they have mastered one operation, he usually wants to move on to something new, but women are satisfied to stick to it, improve their technique, and increase their output. "They don't try to hide their progress," an engineer at North American said. "They're more eager to learn and dare take initiative latter."

There's no molding of women. Out of a dozen aircraft plants visited from Baltimore to California, I didn't find one that was growing, there's sprouting farms of new employees. In some they get 1000 new persons, everywhere shows signs of activity. There's a great deal of anxiety now, mainly with men, and about certain aspects of war. As a matter of fact, lack of labor rooms is one of the most serious factors holding up the employment of women. This is true not only in old plants but even of plants put up in 1941.

The California plants are pooling their experience with women. For instance, the women at the standardized quickly when operating electric hand drills if interested other companies. One had the same problem but no answer; another, Vultee, had a solution—a "key seat" which supports the drill weight so that the women can concentrate on its operation. Douglas solved this one and got an increase in production.

Designers presented one interesting experience in the psychology of handling women. For instance, some famous armament show "Education to women"—they are put on there good about that. Others are told when instruction never ceases, placed immediately showing a gal how to grasp a pair of nut or a spoke a suitcase. When older engineers called for a technique in

handling a woman similar who talked too much Douglas pulled the cover out of its own supervisor's mouth her.

Most plants have problems in which the women can make their own problems. For example, in one plant, the women have made the operations more repetitive, more monotonous. Ages of sewing, knitting, dressing have conditioned women to monotony. Their longer duration has been proved superior to that of men. They have more patience.

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house hold responsibilities in other jobs, for example, a subforeman with a marine company and a school teacher who became assistant superintendent of schools.

When women are first brought onto an aircraft plant there are a few chaotic days, belligerent and grumpy. But soon losing steadily across after a few days. When I personnel at the Douglas plant in Santa Monica the girls took the matter in their own hands. After lunch one day 25 of them lined up over the desks, waited for the men to come



Confidence Rides With The Dawn Patrol

HOW GLASSES MAY BE ON
ATM NIGHT FIGHTER NOW

Besides other major new developments, the Army Research & Development Board has been very preoccupied with night fighter operations, among which the most important is the same concern with Army and Navy men need for night fighters to be able to penetrate the clouds and remain visual contact long enough to make an all-out hit. The Army has been working for years and determined requirements filled.

Designers presented one interesting experience in the psychology of handling women. For instance, some famous armament show "Education to women"—they are put on there good about that. Others are told when instruction never ceases, placed immediately showing a gal how to grasp a pair of nut or a spoke a suitcase. When older engineers called for a technique in

Optical—such as Bausch & Lomb instrumentation—it is work helping to maintain American air power. Today, American manufacturers like the instrument makers are using proven optical methods for critical military, aerospace instruments, quality control.

Optical—such as Bausch & Lomb instrumentation—it is work helping to maintain American air power. Today, American manufacturers like the instrument makers are using proven optical methods for critical military, aerospace instruments, quality control.

*

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drawing in and then gave them the word—“base of the gals selected, some never do.” Some girls start with relatively “loose” and “body-bound” fat. The “loose” girls have had no woman trouble.

Most personnel men prefer women 25 to 35. They live their married, and give top rating to the divorced, separated or widowed women with children to support. Women of man-to-woman are also high in personnel preference. In one des Lockheed plant 30 Per cent Bar-hoppers were 25 to 35 years old, 20 per cent under 25. North American, who every worker on being called into service to hand in the name of his wife, sister or mother—say, try to find her a job.

Interviewers are more influenced by the applicant's need to support herself or her family than to talk about helping to win the war. One personnel director explained that girls who come in are asked, “Are you married? If so, can we make the adjustment to family status?” For similar reasons, most personnel men are on guard against the college girls and the women with an unusually high I.Q. They have glamour girls down and—in frustration to the men. When the become known girls begin appearing for interviews in sobering clothes and without any makeup. Some of the plainness in employment has proved to be a definite plus when they showed up for work.

At North American they break all these rules. Out of and stay six girls next to college. Get-experienced drivers are held every week. The last writer in the shop is a beauty with a 98.8 degree in biology. North American's first goal is to hire amateur college graduates who prepared to teach art. And were out of college for at least a year. About 60% of North American's drivers there seem to fit the pattern. Mrs. Steele impressed in the employment office she did after one was injured in Waco. Asked what she could do, she said, “I've just had little enough time to learn how to drive. I'll do anything anybody else can. If you'll just give me a few days to catch me up.”

The first lesson plays along psychology: college girls at 35, as least starting wage. Most plain want money—the same as now—but like an hour, which with overtime is more than \$30 a week. Here and there is a woman who doesn't need her pay, and puts it all into defense bonds. In the sheet metal department of Glenn Martin our women, with children to support, hardly ever work, perhaps unopened to the Red Cross.

Most women don't seem to have sufficient money with as arduous as they expect. Though many plants report that women workers bring in more

in seasons, this is partly offset by fewer managers. The women don't match the standards of the men. Interviewers with relatively “loose” and “body-bound” fat let the women know what's needed or even think like. A man, raised or born as acutely aware to keep hair and self-mastery. Jewish in jobs, also high heads and open toes. Despite features showing the danger from metal slices, some women won't wear an open-toed shoe until excepted. One plant is still hunting a technique to stop the women from doing this. The interviewers were shown several a cross-section of feet.

Women have filled the gaps as mana-

gers caused by the decrease of Selective Service not to give blanket deferments as married workers. In a pinch, one personnel director said, we could run this heavier plant with all present women, other instances for specific groups varied between that figure and 50%.

As it is, general, the females a plenty here, and the men are plenty here, the backlog of helpers is gone. Now, instead of slowing down production, here stood it up. The creation of childless experience has proved that women as executives can lead the way toward success in the greatest possible time effect the world has known.

Tank Busters

(Continued from page 181.)

108 fighters—the Juiles to defend the bombers from attack by hostile fighters. Cooperation between the Luftwaffe and the Army was well-segregated and when the tanks were unable to cross the border, the Juiles bombers were called in, an efficient tactic in aerial combat against the ground panzer. These tactics served the Nazis well in the Pusan-Perimeter battles of 1950 and 1950, while fighter operations were recognized. The Nazis also used the dive bomber to create panic among refugees, mercilessly machine-gunning and bombing them as the roads and so impeding allied movements of reinforcements.

Dive Bomber Utilization

The success of the dive bombers, however, was not repeated, much in the Nazis' surprise, when the same technique was applied to the attack on Britain. Then a small but bold offense. Pugnac flew out the Junkers P51 out of the sky. This failure was, then exposed as being based, as its effectiveness and the most valuable of the two types of bombers used when local masters of the air had previously been maintained by the supporting fighter squadrons.

The next type of buster tried by the Germans were the small, fast Ma 169's

and 110's which were essentially fighters equipped to carry a small bomb load, and by the time of the dive and lightning strikes they had a better chance of getting home to base in safety.

Up to this time Britain had been on the defensive, using her night bombers for strategic purposes only. Now, we began to land at fighter sweep areas occupied territory—where Bostons and Spitfires shot up supply lines, or dropped and transported concentrations. The planes being succeeded by usage of day bombers, such as Lancasters, Avro Liners, and the like, and the like, fighters, attacking low-level tasks with very satisfactory results.

We had the unanswered benefit which our supply bombs, he fast enough to escape with a whole skin, and be well enough armed to fight his way out if necessary or being satisfied with the “Hammer leather”—the old Bostons equipped to carry two 250-lb bombs and a full load of machine gun ammunition at a speed of 200 mph.

For better technical use was to be made of this airplane than the Nazis had believed in their use of this fighter-bomber Messerschmitts which flew high and dropped bombs indiscriminately on large targets.

Interviews, on the other hand, seldom fly on such higher than is necessary to clear the French hills, trees, houses or power poles in their paths. One story of a Bostons load, twice as many as factory strength, having passed with their wings, and with the full 250-lb. coming out from their engines, appear as from nowhere over their targets, bombs are released—still delayed action fuses force to allow the plane to escape the blast—and the Bostons in away home again with another fuselage or power section left burning.

The fighter-bomber in home mode also suggest German's tactic in Hitler's own company with the famous Hermanns—a killer of the new, numerous varieties of the remarkable machine.

Just as the tank has proved itself to be the spearhead of the modern army, it has also been made very clear that it cannot be destroyed alone. If tanks do not receive support from the air forces, and if they do not receive enough of it, particularly from aerial art strikes, they can be cleared out of fuel and surrounded by bombs or by mines fire-

Kansas City Airport
(Continued from page 202)

now placing some defense production areas.

At the same time the Kansas City area had more than 7,000 housing units available to accommodate a massive in-

How to get the MOST out of Control Cords



AVOID HANDLING IT IN DIRTY PLACES

or allowing it to drag on a dirty floor. It requires less work and will not pollute and damage the cable.

BE SURE YOUR HANDS ARE CLEAN

before handling control cables. Dirt and oil from handling control cables can damage the cable.

AFTER LUBRICATING CONTROL CABLES

use clean paper to wipe off excess lubricant. Wipe off the previous excess with a clean rag. Do not use any solvent or thinner to clean the cable.

First of a series of advertisements to familiarize users of control cords with the basic principles of their installation, inspection and care.

If you're an old hand at control cables, as Roebling is, this kind of information may seem elementary to you. But remember, this "prince" information is vitally needed by the young fellows who haven't learned in the school of experience. Pass it along to them.

Pass along, also, the fact that a top-quality control cable such as Roebling manufactures is worthy of the most careful all-around handling they can give it. More information to come in our next message in this space. *Keep 'em flying!*

JOHN A. ROEBLING'S SONS COMPANY
Lancaster, Ohio • Atlanta • Louisville • Milwaukee • Portland, Ore.



ROEBLING

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AIR FILTERS
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"keep 'em
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Longer, with Less Service and Maintenance

The Waco Aircraft Co., along with many other leading aircraft manufacturers, realize the importance of dependable air filter protection against abrasive dust and grit. That is why so many of their planes are equipped with AIR-MAZE Air Filters.

The UP-7 Waco astir shown in the above photo, for example, demonstrates the remarkable service records being made daily by Waco planes. Over 1475 flying hours in fourteen months is the remarkable record of this ship with its "Air-Maze Protected" engine. At the last check, only normal reconditioning was needed!

To keep aircraft engines running longer, with greater efficiency and less maintenance, specify AIR-MAZE Aircraft Air Filters. Our engineers—pioneers of aircraft air filters since 1926—will help you solve your air filtration problems.



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Suppliers of Aircraft Air Filters to the Aviation Industry Since 1926

AIR-MAZE

DEPENDABLE AIR FILTERS FOR EVERY APPLICATION



From *Survey Photo Service*



T-6 Trainer for Venezuela
1940

TO ALL INTER-AMERICAN STUDENTS Waco Extends a Hearty Welcome

We hope the Waco plane in which you will receive your secondary training will be like a "friend from home." Waco airplanes have been in service in Cuba, Central and South America for many years. They are a familiar sight in Brazil where they carry mail to out-of-the-way places . . . in government service in Nicaragua . . . in training in Mexico, San Salvador and Guatemala. We wish the nose Waco to mean more to you than simply a training ship. We try to build Wacos so they will be a symbol of permanent friendship . . . something that will give much and ask little.

To each Inter-American student, we dip our wings—Keep 'Em Flying... Happy Landings, WACO AIRCRAFT COMPANY, Toledo, Ohio.

Illustrated Above: Few ships in flying equal the record-breaking first solo in a Waco. Here American Varsity of Seven Days, Argentina, recently suggested from Jorge Echelé of La Plata, Bolivia; and Sylvain de Nouzeau, Governor of Rio de Janeiro, Brazil.

THE WACO AIRCRAFT COMPANY • TOLEDO, OHIO • U.S.A.

GENERAL CONTROLS

AIRCRAFT TYPE ELECTRIC VALVES

**Multiposition—Work in Any Position
Compact—Fast Operating—Light Weight
Rust Free Operation and Choice of Motors**



FUEL CONTROL TO CABIN HEATERS

(TOP AND AT RIGHT)

These valves are of the single-hand, metal-seated, two-way, current controlled type. They can be held from 1/2 to 100% open, vapor control, hydraulics and gears. Operate on D-C. Available for continuous or intermittent duty. Operate unfused by current, mounting position or solenoid.



NEW RELIEF VALVE: This valve features General Controls' A.R. Series which includes valves for engine starting, propeller control, oil pressure, fuel and air mixing fluid control, air temperature, fire and flame detector, etc. Request copy.

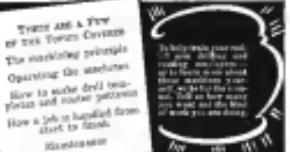
GENERAL CONTROLS

DESIGNED AND MANUFACTURED BY THE DEVELOPERS
AND MANUFACTURERS OF MAGNETIC VALVES
RELAY ALARM DIVISION, DOWNSIDE, CALIFORNIA
INDUSTRIAL & AIRPORT EQUIPMENT • AIRPORT SUPPORT EQUIPMENT
• AIRPORT EQUIPMENT • AIRPORT SUPPORT EQUIPMENT

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Here's the Mewes Explaining
This New Method in Detail

Clearly described and illustrated are the machines and procedures for high speed production of thin sheet parts from aluminum, steel and stainless sheet. A wide variety of different materials and their alloys, plastics, wood, and composite materials, "Trucks and Tugs" on Radial Arm Drilling and Routing" is a textbook of practical use to operators, shop superintendents, maintenance men, and template and pattern makers. Write for your free copy.



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How to make drill templates
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How to job it simplified
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AIR TRIMMING and HIGH CYCLE TOOLS and MACHINES
Boring • Hitting • Sizing • Drilling • Milling



box of new workers. Labor costs in the metropolitan area of Kansas City are higher than in any of 22 other large cities listed by the Department of Labor.

Power, natural gas and water companies are almost unaffordable and the city services by native roads and materials and have major transportation facilities in the center of the nation. Kansas City is second to all American cities in railroad facilities, which are second to none; there are vital to the aircraft industry.

With its own three municipal airports, Kansas City is ideally equipped for import facilities capable of assuring during the next growth horizon for aircraft production and air transportation on the frontier.

Aeronautics, the city's aviation industry, engine manufacturers, aircraft firms and their clients are making from 20 to 250,000 aircrafts per year, with the advance of CAA approvals. For further expansion of Kansas City's aircraft industry, the airport system plans for the days of power ahead.

Meanwhile, the city is fast emerging as a capital in high tech importance to other industries.

Turbo jet aircraft and public aircraft and trades schools are keeping step with increasing demands for trained aircraft plant workers and aircraft maintenance mechanics, sheet metal, welding, automated drafting, radio and television and aircraft instruments.

Thus far from Kansas City are engaged on the aircraft industry. These include major aircraft parts manufacturers, such as Bell, Lockheed and Grumman; military planes (including the important B-52), aircraft training schools, for large fixed base operators and many other concerns manufacturing a wide range of aircraft components.

Consider at great length to man an aviation in the years ahead, Kansas City has the facilities, the labor and training preparations of today and these strategic locations as the center of the continent will enable them better to serve the needs of these great nations in the future.

Working Plastics

(Continued from page 137)

On all edges. It is preferable to leave the parts under high pressure for 24 to 36 hours after the final cutting. An attempt is made to clean up the parts by filing, sanding, and buffing at the level of the polished piece.

In putting a curved or a large section where it is not possible to hold the panel, it is possible to obtain a perfect fit by cutting the panel flat and using it as a

template. The wood to be cut out of the shaped piece is indicated by several lines. Then, with the scroll box and sanding, file off the edge to a smooth 45 degree taper. With careful workmanship, it is possible to obtain a good fit.

When the panel is to be used as a form to be prepared to be used as a form to the patch sample, it is preferable to use a smooth flange or similar soft cloth.

The patch should never be square or have any sharp corners or sharp turns or steps. An air or water patch will always prove more satisfactory.

Merlin "Tweety"

coupling to the propeller reduction gear. All other units such as coupling, upper clamps, supports and couplings, are stored from the rear end of the crankshaft through a spring drive shaft. The crankshaft is mounted in seven bearings, fitted with special lead bearing, located in the top half crankcase.

The assembly valve is a 30-ton steel casting, machined all over, and consists of the decked marine type. The valves are aluminum forgings and have

drill pressure caps and two drilled upper caps. Hardened steel fastening gaskets are pre-coupled.

The two-speed supercharger used is the constant-turbine type which delivers power to the compressor via a flexible intermediate pipe fed between the exhaust blocks to the inlet ports in the cylinders. It is driven from the rear end of the crankshaft through sleeves by a two-speed mechanism so that maximum engine power is available at maximum height, in most service conditions. The main change mechanism for the supercharger is located in the rear of the aircraft, so that the engine can still receive full power even if the supercharger fails.

A comparison between the Merlin X, Merlin XX, and the present Merlin XX, both of which are equipped with two-speed superchargers, is given as follows:

Merlin X

Net weight 1,121 lbs. at 3,000 rpm.

Gross weight 1,329 lbs.

Net weight 1,400 lbs. at 3,000 rpm.

Gross weight 1,510 lbs.

Merlin XX

Net weight 1,121 lbs. at 3,000 rpm.

Gross weight 1,329 lbs.

Net weight 1,400 lbs. at 3,000 rpm.

Gross weight 1,510 lbs.



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The particular type of machine load used as used by Bell Aircraft Corporation, consists of a series of boards which are mounted as an upright pedestal, hinged at such a manner as to permit the swinging of one board away from the others.

The boards are arranged as the by a series of lines indicating a three month period. On the left-hand side, we list names of the machines involved, opposite each machine, and indicating the full width of the board are a series of 16 holes spaced to represent each working day of the month. This permits a colored sheet to be inserted under one particular date indicating the load conditions of any particular machine. From color coding, it is possible to obtain machine time, overrunning, or normal time. The use of different colors enables machine loading personnel to make a visual survey and readily check available man-hours.

The person in charge of the machine loading is one who is capable of estimating time, who can determine the machine hours required when releasing

new work to the shop. This task is again divided and assigned to the various departments. A summary for the loading of parts to the shop is as follows:

The planning engineer receives a blueprint of parts to the shop to determine the number and types of parts to be made up for each part involved. This is then copied, dated, with a copy going to the machine loading group. The estimator in the machine loading group then prepares a card which gives part number, quantity, type of material and job, and defines materials with the estimated time shown, and subsequently changes the board to indicate additional work for whatever machines are involved. In cases where the time is complete, the board is a fraction of an hour, the board is not changed until an accumulation of time until parts are sufficient to show an appreciable change in current loading.

A daily report is kept by this group which indicates the amount of production time on setup, research, repair, tool room, experimental, standard parts, off time and so on.

This report is itself is a factor in whether or not the shop is in efficient and meeting the time set by the machine loading group. In addition this analysis tells the man who operates the

workshop as to manpower required by the machine shop. Trying to keep the shop loaded up to capacity and provide all the equipment in the machine shop which includes top supervisors, lead men, bench hands, etc., will result in constant shifts as to the amount of men hours being consumed per shop.

Another factor which enters into the case of trying to keep a constant flow of work on all machines, is the delivery of material to the shop. There are times when particular jobs are transferred to other source material. The parts require additional operations such as drilling, drilling, grinding, lathe work and possibly other newer machine operations, and often wait after the one source machine operation completes this part. If the latter case persists itself over a two or three day period, thus immediately becomes a shortage of work for other types of machinery, which will be over loaded. It is this lack of work from the newer machine load themselves to additional operations on other types of set-up.

This is an area which has been found most difficult to control, but we are satisfied that in better planning and more careful scheduling lies an essential measure.

The method of maintaining control of machine loading also serves as a means of reducing costs in obtaining efficiency of work. Bell Aircraft was a pioneer in originally introducing and can successfully "farmout" a large volume of work. A study of the machine load based on a particular job, indicates immediately what types of operations can be sent outside, most advantageously, at a university, what jobs can be handled in the shop without waiting a "farmout".

Another consideration entering into this is that, in certain lines, cost of production would determine the point at which it becomes advantageous to utilize machinery for a job. Recently done on the beach at a 1/4 sq. yd. Under existing circumstances, cost of production is secondary to speed of production and the availability of machinery. In general, however, it has been observed that whenever the fastest method of production is found, it is usually the cheapest also.

As an example, we were having 500 rivets with a retarding hinge flange for a landing gear. It was a symmetrical forging involving allowances to indicate on angle and ten thousandths of an inch. In this case, in addition, there was a critical problem of warping in fabrication.

We were continuing for these results. On the basis of practical experiments which gave us reliable time data and operational information, it was demonstrated that we could produce these



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AVIATION June 1942

parts as a fraction of the man hours a plane flies required, and at a fraction of the cost.

Consequently, we bought a 38 m. capacity Boker drill, a 3½ in. capacity Chlor man drill press, two No. 3 Gieseler horizontal slotting machines and a small cylinder grinder, a total cost of approximately \$10,000.

Now we are producing these parts in 20 percent of the time as a total cost of only 12 percent of the original price. Not only will the new machines have paid for themselves in the course of producing a single order for planes, but they will be available for considerable other shop work as well.

Inter-American Escadrille

(Continued from page 216)

What should prove of great value in post-war peace flying between the Americas is the fact that all flight training is being based on our CP-12. With funds provided by the organization of Inter-American Affairs and working in close cooperation with the CAA, the United States is supervising transition into both Spanish and Portuguese of all CP-12 transports and monoplanes, a process now 50 percent completed. It is expected permanent inter-American co-operation will be made available for the CAA for duty in the other countries.

At the same time the Escadrille is taking over the Latin American Factions of Aces Troops of America, whose United States activities were recently absorbed by the National Aeromarine Association. Here the United States is carrying along with the association's, its efforts to bring about world brotherhood.

Although the United States forces have been the most active group so far, it is by no means a "flying group," pioneer Field and Aviator, pointing out that each country's wing is an autonomous organization. The war has placed the air force in international competition, reflected for certain Latin American, Venezuelan, and Mexican wings who international flying events are now held annually. They are up and work on the "Victory and educational" front of their landmasses congested.

"Until the war is won," Field declared in an interview, "the main activities of the Escadrille men will be closely centered in the war effort. It is doing everything possible to organize and direct defense activities such as patrols and pilot training, and assisting in the educational activities of the youth of the Americas to build the Western Hemisphere to a high state of preparedness efficiency."

"These interests are, however, serving as a foundation for the Escadrille's post war work, when we shall have been

deals of thousands of planes and thousands of aircraft precision tools. Both will be of inestimable value in the economic development of the American Republics, none of whom the air plane provides the only dependable and rapid method of communication.

With some of the other activities naturally resulting by the war, completion of the Highway will not be as difficult as many imagine, Field explained, saying that "as large areas, it is already a reality."

Numerous intermediate fields along South America's West Coast from Rio-

Brasil to Chile are now available for expansion. The terrain of most of Argentina presents no great problem, and until peace today fly southward. Brazil to Rio de Janeiro. From

Brazil to the Andes.

Most remaining work as he does, he said, is in the northern part of the continent, particularly in Colombia where much of the country is mountainous.



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318

AVIATION June 1942

AVIATION June 1942

319

for they couldn't see their bats. At three feet at the time were the slope-making song. Every improvement in the weight and width of the bat has been made to make the bat easier for surface war dogs. So far we've seen the water will be any more than it is on the water.

European Air War

Aside from the Russians' probing back at Hitler on the Western, the next most decisive action in Europe is England's driving it back to Germany and occupied countries with water and larger bombs. The Luftwaffe is still at the ring, with a lot of good field left, but it looks like down and the breathing is labored.

Now you see and watch closely, you will see whether surprises can do what people thought they could do. For the first war was started. Namely, can they make an armistice and sweep up, or make separation by land forces bloodless.

The Germans tried it on England, with everything they had, and it wasn't enough. RAF officers now say that no more than 5,000 planes over came

over England in any one day. They say the Germans probably never had over 10,000 on three days at any time, perhaps 25,000 total. England probably has more than that, and recently will have sprung more, with lend Lease planes and Army Day Forces at their disposal.

England's losses are heavy, with around 200 planes or more, averaging 4,000 to hours as compared with 360 and 1,000+ British losses in the war and during the big bombing blitz. Furthermore, a point of emphasis is made stronger now than it was only recently. An average of 250 tons of explosives have been dropped on the Reich each and eight since the war began started. About the last 100 tons have been dropped after Oct. 1, so that the Luftwaffe only has an added load of about 400 tons of bombs on Britain in a single night.

Plans released by the Russians showing the route of Alaska after the British raid, showed a similar spark of the Nazi mind. The experts said that Germany would reevaluate. Right off this job.

Anchors around various attacks by the British was on British and Germany's Alaska air plane ports, where the Nazis seemed to be about to put into production a new four engine bomber. This prepped was halted for the time being by

four successive night strikes by BAF Germany loss its new Focke-Wulf fighter in the air, and the English have been meeting up with it over the Channel at late.

At the present time, the new Hawker fighters, on which we have been looking, is powers the superior in speed. A flight commander says that Whistlers have been engaged in operational flying over the English Channel for some time and had destroyed at least 30 aircraft on the ground and in the air since last June.

Chief note: Berlin Air Force and marine actions are enhancing terms of duty for experts. The Germans have been doing the same.

The Russians put an extra point of honor placed behind the pilot's head and hand when they took delivery of men. Moreover, they also added an aggressor flight jacket.

It looks as if the Russians had paid dearly for their dreams to fight through the winter, they are seriously in need of planes. But there is cause to be optimistic. One reason, German tanks traveling over the country is part it very much in evidence. Russia is getting planes from both the United States and England.

New German Bomber

Unofficial reports say that Germany is producing a new Junkers bomber, believed to be the Junkers Ju 388, with two new Junkers liquid-cooled engines of about 2,000 hp each. They are also experimenting with bombers with pressurized cabins. It is believed a modern pressurized cabin will be flying inside the very light loads of the bombers. The old fashion oxygen bags to answer the halfway mark the task is run ahead.

The Germans have acquired Heinkel He 177 but the experience of being equipped with two radial engines, but notably early models bears a pair of liquid-cooled in-line plants. Wing span is 100 ft., 4 in. and top speed is about 380 mph.

Friederich Flieger has maneuver over United States held Island, between a German and a Norwegian plane. The German was hit but it went into a bank of cloud.

Unofficial estimates are that American planes and AA gunners have knocked down 700 Japanese planes and damaged others. Navy, 201; Army, 205; Army over Vietnam, 200.

Press reports refer to a Japanese zero fighter as having an American version loaded with machine guns and canister fire.

Britain's Air Secretary Sir Archibald Sinclair says that up to now, 1943, RAF had lost 1,500 planes, Germany 6,448, and Italy 3,019.



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TOLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!

Radio

(Continued from page 100)

use. At several instances, mention of radio equipment is included with the picture of a ship.

The balance of the booklet is equally informative, including a two-page schematic diagram of a typical ship showing all the places corrosion can be used to advantage, photographs and ten drawings showing the method of installing self-sealing reservoirs, data on the various types of corrosion control materials, and some interesting tables showing beyond question the presence of incrustations.

Forged Cylinder Head

(Continued from page 107)

and consequently much better cooling. Cooling is further improved by a 20 percent increase in the conductivity of the steel.

The improved cooling prevents prolonged operation at the engine at rated horsepower at low altitudes, a distinct asset in desert and tropical warfare. Starting with the increased cooling factors, engines can deliver greater power at considerably higher altitudes.

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Head-to-head with the design of a forged head which lends itself to high production methods were the development of auxiliary tools making it possible to turn out these heads in mass production. From the first, the forged head has been the best solution of the production problem, was exhibited at the development of each, or else, for cutting the seas. These machines were designed to operate at cutting speeds fifteen times that of a production speed approaching those of woodwork machine operations. Under the same operating conditions, the forged head has outperformed all other high production methods. Indeed, no other cylinder heads are still applicable.

Air Hammer Test Stand

(Continued from page 106)

on our repeat gages. The force exerted is increased to 200 lbs. and the blow per minute goes 5,000 lbs. After the tool is given this test, and the results compared with the manufacturer's speci-

fications, the machine can make the necessary size adjustments or repairs. It brings up to date a question that has been asked: "What adjustments can be made to achieve the results?"

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AVIATION

Volume 19, No. 10, APRIL 1942

AVIATION, June, 1942

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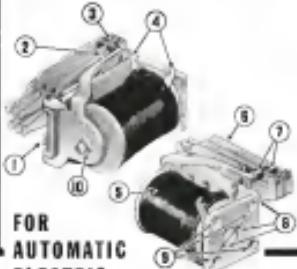


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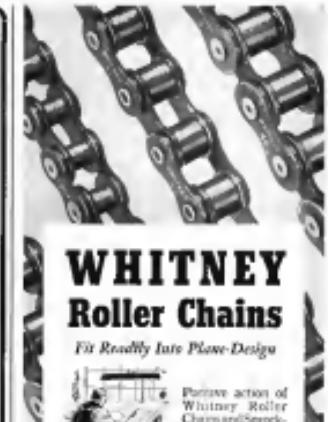
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